School of Psychology and Speech Pathology

A theory-based multi-disciplinary behavioural intervention to promote physical activity and healthy eating in overweight and obese adolescents

Ashley Adair Fenner

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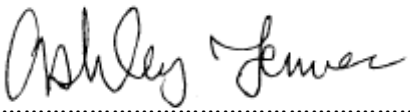
Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature: 

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List of Papers

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Abstract

Self-determination theory and goal setting theory have been independently shown to explain motivation underpinning behaviour engagement, yet no studies to date have combined the two theories in an intervention targeting overweight and obese adolescents. The current study sought to integrate these two theories within the context of a broader study, the Curtin University's Activity, Food and Attitudes Program (CAFAP). The multi-disciplinary family-based intervention aimed to enhance adolescent engagement in physical activity and healthy eating behaviours and was delivered to seven cohorts across three community settings in metropolitan and regional Western Australia using a staggered cohort entry, waitlist controlled design with post-program assessment and follow-up at 3, 6, and 12 months. Effects of the intervention and mechanisms underlying behaviour change were explored in relation to the novel approach of training a multi-disciplinary team of instructors and parents of overweight and obese adolescents to demonstrate need-supportive behaviours.

Fifty six adolescent/parent pairs attended the intervention and analyses were conducted from the final sample of 34 participants providing adequate data at 12-month follow-up. One-way repeated measures ANOVAs and mediation analyses were conducted to determine changes in outcomes following intervention in relation to adolescent variables of autonomous motivation (for physical activity and healthy eating), perceived parent support (for physical activity and healthy eating), psychological outcomes (health-related quality of life and depressive symptoms), behavioural outcomes (self-report and accelerometer-based physical activity; intake of junk food and fruit and vegetable serves), and parent variables of autonomous motivation to support adolescent behaviour engagement (physical activity and

healthy eating) and demonstration of need-supportive behaviours. Differences were demonstrated in all adolescent and parent variables when comparing multiple time points in an ANOVA and when assessed in mediation models.

The current study adds to the knowledge-base for understanding effective mechanisms underpinning motivation for behaviour change in overweight and obese adolescents. Findings indicate that adolescent perceptions of parent support are sufficient to foster changes in psychological outcomes, but more intensive changes in parents' demonstration of need-supportive behaviours are necessary to foster long-term behaviour change in adolescent healthy lifestyle behaviours. Similarly, parents' autonomous motivation to support adolescents appears to play a key role in adolescents' engagement in healthy lifestyle behaviours, although future research with an increased sample size is necessary to fully understand the relationship between parents' receipt of training in need-supportive behaviours and adolescents' long-term behaviour engagement. Implications for further interventions for overweight and obese adolescents include the need to provide parents with more intensive and long-term training in need-supportive behaviours alongside a more supportive guided goal setting structure to enhance participants' ability to more easily integrate concepts from self-determination theory and goal setting theory.

Executive Summary

Adolescence has been identified as a critical period for interventions seeking to reverse trajectories of maladaptive health outcomes likely to track into adulthood. Nearly a quarter of adolescents in Australia are overweight and obese. Engagement in physical activity and healthy eating behaviours have been identified as means to effectively manage overweight, obesity, and associated physiological and psychological outcomes. However, adolescents have been shown to be relatively inactive and a substantial proportion of this age-group fail to meet guidelines for regular daily moderate-to-vigorous physical activity and serves of fruits and vegetables associated with healthy weight maintenance. Reviews of the literature have indicated that targeting motivational processes underlying behavioural engagement is likely to bring about necessary changes. Self-determination theory has demonstrated moderate to strong effect sizes in explaining health-related behaviour, and the application of techniques proposed in goal setting theory have similarly been demonstrated as effective for implementing behaviour plans. Thus, integrating both theories may be useful in developing interventions to foster motivation for, and sustained engagement in, healthy lifestyle behaviours.

Satisfaction of three needs for autonomy, competence, and relatedness are proposed in self-determination theory to lead to improved health outcomes through the promotion of autonomously motivated behaviour. Satisfaction of these needs is posited to be brought about through environmental provisions of need-supportive behaviours: autonomy support, structure, and involvement. To date, no study has trained a multi-disciplinary team of instructors and parents of overweight and obese adolescents in a family-based intervention to demonstrate need-supportive behaviours, which was

postulated in the current study to improve adolescent behaviour engagement and psychological outcomes.

The individual components proposed in goal setting theory to illicit the motivational mechanisms of effort, persistence, and direction include the setting of difficult and specific goals within a proximal and distal timeframe. Family-based interventions targeting adolescent overweight and obesity have to date been limited in the concurrent integration of all necessary goal setting techniques alongside a detailed description of how goals are mapped within a family structure. Structured goal setting content for adolescent and parent goal setting was provided in the current study that allowed for adherence to necessary goal setting techniques as well as collaboration and feedback.

Based on a novel integration of self-determination theory and goal setting theory, the current study aimed to investigate intervention fidelity as well as the effects of the intervention and mechanisms underlying adolescent behavioural and psychological outcomes following involvement in a broader study, Curtin University's Activity, Food and Attitudes Program (CAFAP). The program was delivered to seven cohorts across three community locations and was multi-disciplinary and family-based, targeting overweight and obese adolescents. Adolescents and their parents were recruited to participate using a staggered entry waitlist controlled design, with follow-up assessments conducted at post-program, and 3, 6, and 12 months following intervention conclusion.

The intervention was attended by 56 adolescent/parent pairs, and analyses were conducted from the 34 participants with sufficient data at 12-month follow-up. Effects of the intervention were assessed in relation to outcomes for adolescent physical activity, healthy eating, psychological outcomes (e.g., health-related quality of life and depressive symptoms), autonomous motivation and perceived parent support for healthy lifestyle

behaviours. Differences in parent-reported demonstration of need-supportive behaviours, and autonomous motivation to support adolescent physical activity and healthy eating behaviours were also assessed. Mediation analyses were conducted to assess relationships among outcome variables following intervention, with adolescent perceived parent support and parent autonomous motivation to support adolescent behaviours (e.g., physical activity and healthy eating) as independent variables; adolescent behaviour engagement (e.g., physical activity and healthy eating), and psychological outcomes (e.g., health-related quality of life and depressive symptoms), and adolescent perceived parent support as dependent variables; and adolescent autonomous motivation and parent report of need-supportive behaviours as mediators. Measures of intervention fidelity suggested that effects of the intervention and analyses of underlying mechanisms were likely to reflect participants' experiences of exposure to need-supportive environments.

Results of one-way repeated measures ANOVAs revealed significant differences from entry at post-program and/or follow-up periods in comparison to changes at pre-intervention(e.g., waitlist) for adolescent autonomous motivation (for physical activity and healthy eating), adolescent perceived parent support behaviours (for physical activity and healthy eating), adolescent health-related quality of life, adolescent junk food intake, as well as parent autonomous motivation to support adolescent physical activity, and parent-reported demonstration of need-supportive behaviours. However, no differences were found immediately following intervention, or at follow-up points in adolescent physical activity (accelerometer and self-report), adolescent depressive symptoms, and parent autonomous motivation to support adolescent healthy eating.

Mediation analyses revealed a number of direct relationships across post-program periods, although no indirect (mediated) pathways were supported in relation to

adolescent-reported outcomes. Specifically, adolescent changes following intervention in perceived parent support for physical activity directly predicted improvements in light intensity and total (light and moderate-to-vigorous) physical activity (6 months); autonomous motivation for healthy eating directly predicted increases in fruit and vegetable serves (3 months); perceived parent support for physical activity and healthy eating directly predicted improvements in health-related quality of life (post-program); autonomous motivation for physical activity directly predicted improvements in health-related quality of life (3, 6, and 12 months) as did autonomous motivation for healthy eating (3 months); perceived parent support for physical activity directly predicted reductions in depressive symptoms (3 and 6 months), as did perceived parent support for healthy eating (6 months); autonomous motivation for physical activity directly predicted reductions in depressive symptoms (post-program, 3, 6, and 12 months), as did autonomous motivation for healthy eating (3 months).

Although mediation effects were also tested in relation to parent-reported outcomes, no indirect relationships were supported, despite a number of direct relationships between variables. Specifically, at post-program changes in parent autonomous motivation to support adolescent physical activity directly and positively predicted changes in parent-reported demonstration of need-supportive behaviours and negatively predicted changes in adolescent light physical activity. Changes in parent-reported demonstration of need-supportive behaviours also directly and positively predicted adolescent light physical activity at post-program, 3 months, and 6 months, as well as total physical activity at post-program and 3-months. Further, changes in parent autonomous motivation to support adolescent healthy eating directly and positively predicted adolescent perceived parent support for healthy eating (3 months), adolescent

fruit and vegetable intake (3 months), and negatively predicted parent demonstration of need-supportive behaviours (post-program) and adolescent junk food intake (6 months).

Strengths of the current study included a longitudinal design, exploration of the integration of self-determination theory and goal setting theory, training multi-disciplinary teams of instructors and parents of overweight and obese adolescents in need-supportive behaviours, as well as an objective measure of physical activity and a clearly defined method for implementing a goal setting structure within a family context. Despite these strengths, the small sample size and modest statistical power may have limited the number of statistically significant findings that could be identified. In addition, findings may have also been limited due to response biases or the causality orientations of instructors or parents in respect to their willingness to take on training targeting their demonstration of need-supportive behaviours.

Theoretical implications based on findings from the current study suggest that adolescent perceptions of parent support may be sufficient to foster changes in psychological outcomes, but perceptions alone may not compensate for limited intensity of changes in actual need-supportive behaviours in predicting more difficult to change adolescent behaviour outcomes (e.g., moderate-to-vigorous physical activity and fruit and vegetable intake). Further, parents' autonomous motivation to engage in need-supportive behaviours is likely necessary for understanding adolescents' autonomous motivation and subsequent behaviour engagement, although further research is needed to clarify this relationship.

Practice implications include the need to train parents in need-supportive behaviours, but this may necessitate more intensive and persistent training given the well-established relational patterns between parents and adolescents. Concepts from self-

determination theory and goal setting theory are likely to improve behavioural engagement; however, less emphasis could be placed on self-generated goals and more on guided selection of pre-set goals to reduce participant burden. Delivering concepts from multiple disciplines may also be best accomplished using sequential introduction, rather than simultaneous, again to reduce cognitive burden. Future studies should also aim to investigate the mediation pathways proposed in the current study, although attempts should be made to include a larger sample size and measures of adolescent need-support along with independent raters' perceptions of parents' demonstration of need-supportive behaviours.

The current study demonstrated that a program based on self-determination theory and goal setting theory could be delivered by multi-disciplinary teams of instructors in a family and community-based intervention with the ability to change adolescent autonomous motivation, behavioural and psychological outcomes related to physical activity and healthy eating, as well as parent autonomous motivation to support adolescent healthy lifestyle behaviours and demonstration of need-supportive behaviours. Such changes can contribute to sustained behavioural changes in overweight and obese adolescents, which is likely to improve their physical and psychological life course trajectories.

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Chapter 1

Introduction

1.1 Significance of Overweight and Obesity in Adolescents

Overweight among adolescents is defined as a body mass index (BMI: weight/height^2) between the 85th and 94th percentile for age and sex, and adolescent obesity is defined as having a BMI ≥ 95th percentile. Overweight and obesity is prominent in developed/industrialized countries where more than 20% of adolescents are classified as overweight or obese (Janssen et al., 2005; Olds et al., 2011). In Australia specifically, rates of overweight and obesity in adolescents have doubled in the past 25 years (Olds, Tomkinson, Ferrar, & Maher, 2009), with current figures indicating one in four adolescents are overweight or obese (Australian Bureau of Statistics, 2012). The high prevalence of overweight and obesity in adolescents presents a major public health concern due to the associated maladaptive health outcomes including type 2 diabetes (Tirosh et al., 2011), cardiovascular risk factors (Lawlor et al., 2010; Sorof, Lai, Turner, Poffenbarger, & Portman, 2004), depression (Luppino et al., 2010; Pash, Nelson, Lytle, Moe, & Perry, 2008), anxiety (Rofey, Kolko, & Iosif, 2009), and both low quality of life (De Beer et al., 2007) and self-esteem (Griffiths, Parson, & Hill, 2010). Overweight and obesity during adolescence is also highly predictive of adult overweight and obesity (Freedman et al., 2005) and continued persistence of physical and psychological consequences. Given the weight trajectory associated with adolescent weight status, adolescence has been identified as a critical period for intervention seeking to reduce lifetime overweight and obesity (Dietz, 1994).

1.2 Adolescent Behaviours

Dietary and physical activity behaviours have been consistently shown to be associated with adolescent obesity (Berkey, Rockett, Gillman, & Colditz, 2003; Bradlee,

Singer, Qureshi, & Moore, 2010; Huang, Norman, Zabinski, Calfas, & Patrick, 2007; Schmalz, Deane, Birch, & Krahnstoever, 2007). Dietary intake associated with obesity includes greater consumption of junk food and limited intake of healthier foods such as fruits and vegetables (Kant, 2003; Y. Wang, Ge, & Popkin, 2003). A lower frequency of engagement in physical activity is also linked to obesity in adolescents (Reichert, Baptista Menezes, Wells, Carvalho Dumith, & Hallal, 2009). Recommendations for adolescent physical activity are defined as a minimum of 60 minutes per day spent in moderate-to-vigorous physical activity, yet less than half of adolescence in western countries meet these guidelines and these shortcomings are even more pronounced in obese adolescents (Belcher et al., 2010).

Establishing healthy lifestyle behaviours during adolescence is critical given habits formed in adolescence underpin lifelong behavioural patterns (Currie, Hurrelmann, Settertobulte, Smith, & Todd, 2000; Story, Neumark-Sztainer, & French, 2002). For instance, availability of unhealthy food during adolescence has been shown to be correlated with fast food intake in adulthood as well as perceptions of barriers to healthy eating such as time and taste (Larson et al., 2008). Low frequency of engagement in physical activity during adolescents is also shown to be associated with difficulty experienced in adulthood when attempting to integrate physical activity into one's daily routine (Hirvensalo & Lintunen, 2011).

1.3 Theories of Motivation in Obesity Intervention

Despite the well-established need for interventions targeting adolescent obesity, interventions to date have demonstrated relatively limited success in combating the staggering rates of obesity (Metcalf, Henley, & Wilkin, 2012). Reviews of theoretical practices indicate that if interventions are to be effective, motivational processes underlying adolescent engagement in physical activity and healthy eating must be targeted to facilitate

persistence in these behaviours and thus foster long-term maintenance of a healthy body weight (Buchan, Ollis, Thomas, & Baker, 2012; Hagger & Chatzisarantis, 2009). Among the available theories underlying behaviour change, two theories of motivation that have been identified as showing some promise in promoting sustained behaviour change: self-determination theory (Deci & Ryan, 2000) and goal setting theory (Locke & Latham, 1990). Despite evidence supporting interventions based on these theoretical underpinnings (Shilts, Townsend, & Dishman, 2013; Van den Berghe, Vansteenkiste, Cardon, Kirk, & Haerens, 2012), interventions have only examined the independent contributions of each theory, and none have considered the integration of these theories in a behaviour change intervention. Given the importance of addressing motivation in the role of adolescent obesity, it is important to explore whether an intervention based on the integration of self-determination theory and goal setting theory can promote adolescents' engagement and maintenance of physical activity and healthy eating behaviours.

1.4 Role of Families in Obesity Intervention

Family food environments have been identified as one of the most significant influences on adolescents' eating habits (J. P. Taylor, Evers, & McKenna, 2005), with particular regard to development of food preferences, patterns of food intake, and eating styles (Birch & Davison, 2001; N. Pearson, Biddle, & Gorely, 2009). Adoption of these behaviour patterns may be shaped by parent behaviours associated with adolescents' motivation such as controlling food environments (Birch, Fisher, & Davison, 2003), food availability (Boutelle, Birkeland, Hannan, Story, & Neumark-Sztainer, 2007; Ezendam, Burg, Borsboom, van Empelen, & Oenema, 2012), access to activities (Zabinski, Saelens, Stein, Hayden-Wade, & Wilfley, 2003), behaviour modelling (Boutelle, Fulkerson, Neumark-Sztainer, Story, & French, 2007), joint participation in behaviours (Bauer, Neumark-Sztainer,

Fulkerson, Hannan, & Story, 2011; Davison, Francis, & Birch, 2005; Madsen, McCulloch, & Crawford, 2009), and autonomy support for adolescents' behaviour choices (Hagger et al., 2009).

Given parents' position as the primary gatekeeper of adolescents' adoption and persistence in physical activity and healthy eating behaviours, parents' ability to provide avenues for healthy lifestyle changes have been shown to predict adolescent weight status (Berge, 2009). Parental ability is largely influenced by knowledge of nutrition and physical activity behaviours (e.g., intensity, duration, and access) (Corder et al., 2010; Gibson, Wardle, & Watts, 1998) as well as an understanding of how to perform support behaviours (M. Campbell, Benton, & Werk, 2011). Educating parents about healthy lifestyle behaviours is therefore necessary to positively influence the provision of food choices and physical activities available in the home environment, which in turn will enhance adolescents' availability of healthy eating and physical activity resources (Epstein, 1996). Likewise, an important task of interventions is to teach parents how to provide these support resources and to assist in fostering their adolescents' motivation to maintain healthy lifestyle changes (K. Cullen, 2011). By assisting parents in understanding their role in motivating their adolescents, as well as fostering parents' motivation and engagement in support behaviours responsible for motivating behaviour change, adolescents are likely to benefit from exposure to family environments that promote healthy lifestyle behaviours (Lindsay, Sussner, Kim, & Gortmaker, 2006).

1.5 Multi-Disciplinary Approach

Increasingly, expert recommendations have begun to note the critical need for development and implementation of family-based multi-disciplinary approaches to reduce adolescent obesity (Oude Luttikhuis et al., 2009; Pratt et al., 2011; Young, Northern, Lister,

Drummond, & O'Brien, 2007). Multi-disciplinary approaches focus on implementing methods drawn from a range of disciplines (e.g., psychologists, physiotherapists, and dieticians). Further, reviews of the literature specify that multi-disciplinary interventions must be delivered by a team of experts inclusive of professionals with knowledge on behavioural counselling (e.g., psychologist, social worker, trained nurse), as well as dieticians, and exercise specialists (Spear et al., 2007). Targeting the adoption of healthy lifestyle behaviours based on multi-disciplinary methods and implementation has been shown to be superior to focusing on behaviour modifications within the context of a sole discipline (Wilfley et al., 2007). Optimal results are thus likely to occur when methods from multiple disciplines are implemented within the context of family environments (McGovern et al., 2008). More specifically, exploring the integration of self-determination theory and goal setting theory is likely best placed within a multi-disciplinary family-based context to maximize benefits of integrating the two theories of motivation.

1.6 Aim of Study

The current study was conducted in the context of a broader study that sought to evaluate the effectiveness of a family-based multi-disciplinary intervention aimed at modifying overweight and obese adolescents' physical activity and healthy eating behaviours (Straker et al., 2012). The intervention was delivered in community settings over an 8-week period and named Curtin University's Activity, Food and Attitudes Program (CAFAP). The aims of the current study were to assess intervention fidelity (aim 1), test the effects of the intervention (aim 2), and to investigate the mechanisms underlying the effects of the intervention (aim 3) on adolescent behaviour changes based on the integration of self-determination theory and goal setting theory. Mechanisms underlying behaviour change included the previously unexplored modification of program and home

environments to support self-determined motivation and setting behaviour change goals based on a goal setting framework that promoted goal strivings in a need-supportive context. Exploration of the complementary framework based on self-determination theory and goal setting theory was integral to the development of the CAFAP intervention seeking to modify behaviour within the family context to promote adolescent engagement in physical activity and healthy eating behaviours.

1.7 Objectives

The following objectives were assessed to explore aims of the current study.

Objective 1: Determine fidelity of intervention delivery based on reports from instructors, participants (adolescent and parent), and independent rater observations.

Objective 2: Determine effects of an intervention underpinned by self-determination theory and goal setting theory on the following variables:

- Adolescent perceived parent support for physical activity (2.1) and healthy eating (2.2)
- Adolescent autonomous motivation for physical activity (2.3) and healthy eating (2.4)
- Adolescent physical activity (objective 2.5) and healthy eating (objective 2.6)
- Adolescent quality of life (psychosocial, physical, and health) (objective 2.7) and depressive symptoms (2.8)
- Parent autonomous motivation to support adolescent physical activity (objective 2.9) and healthy eating (2.10)
- Parent demonstration of need-supportive behaviours (2.11)

Objective 3: Mechanisms underlying the effects of the intervention were assessed using a series of mediation models exploring the following hypotheses:

- changes in adolescent autonomous motivation were hypothesised to explain the relationship between changes in adolescent perceived parent support and changes in the following adolescent outcomes:
    - physical activity behaviours (objective 3.1)
    - healthy eating behaviours (objective 3.2)
    - health-related quality of life (objective 3.3)
    - depressive symptoms (objective 3.4)
- changes in parent demonstration of support behaviours were hypothesised to explain the relationship between changes in parent autonomous motivation to support adolescent behaviour engagement and changes in the following adolescent outcomes:
    - perceived parent support (objectives 3.5, 3.6)
    - physical activity behaviours (objective 3.5)
    - healthy eating behaviours (objective 3.6)
- changes in adolescent autonomous motivation were hypothesised to explain the relationship between adolescent goal attainment and changes in the following adolescent outcomes:
    - physical activity behaviours (objective 3.7)
    - healthy eating behaviours (objective 3.8)
- changes in parent autonomous motivation to support adolescent behaviour engagement were hypothesised to explain the relationship between parent goal attainment and changes in the following adolescent outcomes:
    - physical activity behaviours (objective 3.9)
    - healthy eating behaviours (objective 3.10)

1.8 Benefits of the Study

Current prevalence rates of adolescent obesity, in Australia and worldwide, clearly indicate the limited success of interventions to date at reducing a significant public health burden. If interventions are to be effective, innovative methods need to be explored to help inform change mechanisms based on theory-driven findings. The current study addressed previous shortcomings by examining mechanisms underlying the unique contribution of an intervention integrating two theories of motivation: self-determination theory and goal setting theory. Although there is evidence of self-determination theory and goal setting theories individually informing motivation for behaviour change, the two theories have not been jointly explored in a behaviour change intervention targeting adolescent obesity. Endorsement of a complementary approach was advantageous compared to previous methods by creating an intervention environment that used goal setting techniques outlined in goal setting theory to provide a structure for engaging in future behaviours while using concepts from self-determination theory to guide the content of these goals to ensure set goals were relevant to personally-endorsed motives required for sustained behaviour changes. Adolescent and parent goal strivings occurred in the context of environments that fostered adolescents' autonomous motivation to engage in healthy lifestyle behaviours, and parents' autonomous motivation to support these behaviour changes. Findings from the study will improve the application of theory-based approaches underlying interventions targeting adolescent obesity.

1.9 Structure of Thesis

The thesis describes the rationale for developing a family-based multi-disciplinary intervention targeting adolescent obesity based on the theoretical underpinnings of self-determination theory and goal setting theory. Methods for implementing the theory-based

mechanisms are then outlined and results reported in relation to intervention fidelity, effects of the intervention, and mechanisms underlying changes following intervention delivery. The chapters detailing this process are described briefly below:

Chapter 2: Literature Review: The literature review begins with an introduction of the individual benefits of considering self-determination theory and goal setting theory and then moves on to describe how the benefits of each theory are maximised by integrating concepts from both theories. Contributions of each theory are reviewed in the context of health behaviour change interventions and knowledge gaps identified. Finally, the rationale is presented for the development of mechanisms underlying behaviour changes in the current study.

Chapter 3: Methods: Details of methods employed in the current study are provided to describe the development and implementation of motivational mechanisms underlying behaviour change, and evaluation instruments used to assess these mechanisms.

Chapter 4: Results: Sample characteristics are described followed by a report of findings in relation to intervention fidelity and results of analyses exploring effects of the intervention and outcomes from the hypothesised mediation models used to describe the motivational mechanisms underlying changes following intervention.

Chapter 5: Discussion: A summary of the main findings and the implications of these findings are discussed. Strengths and weaknesses are also identified and suggestions for future studies are provided alongside theoretical and clinical implications.

Chapter 2

Literature Review

2.1 Introduction

This chapter outlines the theoretical rationale underlying the development of intervention components and research objectives presented in the current study. Content in the current study is specific to motivational mechanisms that underpinned behaviour changes targeted within the broader study of Curtin University's Activity, Food and Attitudes Program (CAFAP) (Straker et al., 2012). Rationale for arriving at study objectives are detailed with regard to two theories of motivation: self-determination theory (Deci & Ryan, 2000) and goal setting theory (Locke & Latham, 1990). First, the salient aspects of self-determination theory are outlined to explain motivation for behaviours, followed by a discussion of how these aspects have informed the development of behaviour change interventions in health behaviour. Second, goal setting theory is reviewed in the context of a motivational framework for implementing behaviour change plans. The chapter concludes with a discussion of how methods from goal setting theory can be enhanced by considering integration with concepts from self-determination theory.

2.2 Self-Determination Theory

2.2.1 Overview. Self-determination theory is a meta-theory of motivation based on the key premise that individuals have an inherent tendency toward psychological growth and integration of experiences to form a unified sense of self (Deci & Ryan, 1991, 2000). It is postulated within self-determination theory that these organismic tendencies will be optimised to the extent that environments satisfy three basic needs for autonomy, competence, and relatedness (Deci & Ryan, 1985).

The need for *autonomy* reflects the desire to be the origin of one's choices and behaviours in accordance with one's values (Deci & Ryan, 1985). Autonomy occurs when people feel a sense of volition in their behaviour choices and perceive themselves as the perceived source of causality as opposed to being controlled by external agencies. The need for c*ompetence* involves an individual's desire to master effective interactions with the environment (Deci & Ryan, 1980). Competence occurs when an individual feels capable in meeting challenging tasks and succeeding in desired outcomes. The need for *relatedness* refers to an individual's desire to feel connected to others in supportive social relationships (Deci & Ryan, 2000). Relatedness occurs when a person achieves a sense of belonging and feels understood by others.

Needs for autonomy, competence, and relatedness are considered within self-determination theory to be innate and essential for healthy development regardless of culture, gender, or age (Deci & Ryan, 2000). Empirical studies have supported these contentions in demonstrating positive associations between need satisfaction and adaptive functioning across diverse cultures (Chirkov & Ryan, 2001; Chirkov, Ryan, & Willness, 2005; Ryan, La Guardia, Solky-Butzel, Chirkov, & Kim, 2005; Vansteenkiste, Lens, Soenens, & Luyckx, 2006), genders (Ntoumanis, 2001; Standage, Duda, & Ntoumanis, 2005), and age groups (Brunet & Sabiston, 2010; Deci, Driver, Hotchkiss, Robbins, & Wilson, 1993; Grolnick, Frodi, & Bridges, 1984; Grolnick & Ryan, 1989; Niemiec et al., 2006).

Organismic integration theory (OIT; Deci & Ryan, 1985), a sub-theory of self-determination theory, describes the quality of individuals' motivation in the context of need satisfaction, and asserts that adaptive outcomes result from behavioural pursuits regulated by more self-determined, or autonomous forms of motivation. Shifts in individuals' perceived behaviour causality toward more autonomous forms of motivation is understood

to reflect the degree to which needs for autonomy, competence, and relatedness are satisfied in one's environment. Variations in the ensuing motivations are addressed within OIT in the context of two overarching forms of motivation: intrinsic and extrinsic. *Intrinsic motivation* refers to people freely choosing to engage in activities out of inherent interest and enjoyment, without the necessity of any external contingency or reinforcement (Deci & Ryan, 2000). When individuals are intrinsically motivated, task persistence is considered to be due to personally initiated self-determination and factors inherent in the task itself, rather than being dependent on external contingencies. In contrast, e*xternal regulation* involves individuals behaving with the intent of obtaining a desired consequence (e.g., reward) or avoiding an undesired consequence (e.g., punishment, shame, guilt), such that their actions are initiated only when the action is a means to those ends (Deci & Ryan, 1985).

Individuals' innate tendency to satisfy basic needs is conceptualised in OIT through the process of internalization or integration, whereby individuals' perceived causality of their behaviour shifts from extrinsically motivated behaviour to behaviour motivated by more self-determined reasons that are need-satisfying (Deci & Ryan, 2000). More specifically, internalization occurs when individuals are not inherently interested in a task, but the task is necessary for effective functioning. Internalized behaviours are not intrinsic, but have been brought into the individuals 'repertoire' of behaviours that service internally-referenced, personally-endorsed autonomous goals and outcomes. Extrinsic motivation is therefore proposed to be multi-dimensional, reflecting a range of motivational orientations that vary in the degree to which they are controlled or autonomous, or the degree to which a motivation is self-determined. A continuum of behavioural regulations is proposed in OIT to organise these distinct levels of internalization (Figure 1). Ranging from least to most self-

determined, extrinsic motivation is divided into the following regulations: extrinsic regulation, introjected regulation, identified regulation, and integrated regulation (Deci & Ryan, 2000).

External regulation is the most controlling form of motivation and refers to individuals performing a behaviour to gain a reward or avoid punishment (Deci & Ryan, 2000). For instance, an adolescent engaging in healthy eating behaviours due to external regulations may be motivated to increase daily fruit consumption to meet demands enforced by a doctor or to avoid peers negatively evaluating his/her appearance.

Introjected regulation involves performing behaviours due to internal pressures or compulsions (Deci & Ryan, 1985). An example of introjected regulation is contingent self-esteem, where individuals engage in a behaviour to maintain feelings of self-worth referenced outside the self, such as doing something to gain approval from others (Ryan, 1982). A parent motivated to exercise with his/her adolescent in order to avoid feelings of guilt associated with not raising physically active offspring would be motivated by introjected regulation. Because these regulations remain mostly external to the self and have not been fully internalized the resulting behaviours are not self-determined and instead remain controlled. Due to the partial internalization, introjected regulations are proposed to be more likely to be maintained over time in comparison to external regulations, although a person with introjected regulation is likely to be highly vulnerable to persuasion (Koestner, 1996).

Identified regulation entails people identifying with the value of a behaviour but not necessarily enjoying the activity (Deci & Ryan, 2000). For example, individuals who align the importance of regular exercise with their personal identity are motivated to exercise out of identified regulation. In such instances, the behaviour is proposed to be more autonomous

and less controlled than introjected regulation but is still extrinsically motivated because the behaviour is not solely performed as a source of satisfaction and interest. Regulations that are identified become personally important, and are thought to be maintained with higher commitment and performance than introjected regulation (Deci & Ryan, 2000).

Integrated regulation is the most complete form of internalization of extrinsic motivation and the regulation in which externally-referenced motives have become truly autonomous and are thus self-determined (Deci & Ryan, 2000). When regulations are integrated people have fully accepted the behaviour as an integral part of their personal identity and perform the behaviour in congruence with values and interests that define who they are. However, integrated regulation is still considered external motivation and has not become intrinsic motivation because a person does not engage in the behaviour purely out of interest but rather because the activity is performed for instrumental reasons (Deci & Ryan, 2000). For example, when physical activity behaviour is integrated, a person is proposed to identify with the importance of physical activity for their health and well-being, and the regulation of physical activity behaviour is thought to be integrated with other aspects of their lifestyle such as healthy eating.

Situated at each end of the continuum, intrinsic motivation and amotivation describe the two extremes of self-determined behaviour (Deci & Ryan, 2000). *Intrinsic motivation* is conceptualised as the prototypical form of autonomous behavioural regulation and involves people engaging in motivation out of inherent interest and enjoyment (Deci & Ryan, 1985). In contrast to autonomous forms of extrinsic motivation (e.g., identified and integrated), which represent varying degrees of self-determined extrinsic motivational orientations, intrinsic motivation is inherently autonomous and is proposed to be the standard for autonomous motivation in which extrinsic forms are measured against to determine their

degree of self-determination (Deci & Ryan, 2000). Intrinsic motivation is thought to be the prototypical form of regulation associated with sustained behaviour change because it leads individuals to engage in behaviours without the need for external reinforcement (Ryan, Patrick, Deci, & Williams, 2008). An adolescent who chooses to engage in physical activity due to feelings of enjoyment when physically active is considered to be intrinsically motivated.

Amotivation is defined as lacking any reason or motive to act, and thus void of motivation (Deci & Ryan, 1985). When amotivated, people are said to find no value or interest in the activity, or believe there is no contingency between the action and outcomes (Deci & Ryan, 2000). A person may also be amotivated because they lack confidence in the activity due to limited skills or knowledge necessary to carry out the activity. Amotivation is non-self-determined and in contrast to intrinsic and extrinsic forms of motivation on the continuum. Outcomes associated with amotivation are therefore proposed to be maladaptive (Ntoumanis, Pensgaard, Martin, & Pipe, 2004; Ryan & Deci, 2002).

In contrast to other theories of motivation, by focusing on individuals' satisfaction of innate needs, outcomes related to individuals' motivation can be predicted through understanding environmental conditions necessary for optimal functioning. As such, self-determination theory provides an ideal framework for understanding the quality of one's motivation and how interventions can be targeted to enhance environmental factors responsible for predicting autonomous forms of motivation.

Support for self-determination theory as a preferred conceptual framework in understanding and developing interventions targeting motivational processes was shown in a recent meta-analysis demonstrating moderate to strong effect sizes for need satisfaction and autonomous motivation in predicting positive health outcomes (Ng et al., 2012). The

following sections provide a review on the benefits of considering autonomous motivation within interventions targeting behaviour change, and how interventions based on self-determination theory may enhance individuals' autonomous motivation.

2.2.2 The role of autonomous motivation in behaviour change processes. The continuum of motives posited in OIT does not suggest that people progressively move through each type of motivation, but instead proposes that individuals can take in a new behavioural regulation at any point along the continuum, contingent on their experiences and environmental circumstances (Deci & Ryan, 1991; Ntoumanis et al., 2004). A primary objective of interventions seeking to change behaviour via motivational mechanisms is thus the provision of environments that promote autonomous motivation such that individuals are reinforced intrinsically for behaviour engagement without the need for external rewards (Hagger et al., 2013). Substantial evidence has been provided in support of the contention proposed in self-determination theory that autonomous, relative to controlling, forms of behavioural regulations yield not only positive behavioural outcomes, but also more adaptive cognitive and affective outcomes (Ntoumanis, 2012; Williams, Teixeira, Carraça, & Resnicow, 2011). Given the importance of autonomous motivation in predicting adaptive states, evidence is reviewed below with regard to the benefits of including autonomous motivation in predicting optimal functioning.

2.2.2.1 Autonomous motivation and cognitive outcomes. Turning first to cognitive outcomes, more autonomous behavioural regulations in adolescents have been shown to negatively predict boredom and to positively predict adolescents' concentration in physical education (Ntoumanis, 2001, 2005; Standage et al., 2005), importance placed on physical education (Murcia, González-Cutre, & Pérez, 2009), and attitudes toward physical activity during leisure-time (Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005).

Intention to be physically active in leisure-time has also been shown to be positively predicted by autonomous motivation in adolescents (Hagger, Chatzisarantis, & Biddle, 2002; Lim & Wang, 2009) and adults (Wilson & Rodgers, 2004).

While no studies have examined cognitive outcomes in adolescent samples with regard to eating behaviours, in a sample of university students (*n* = 511), Hagger, Chatzisarantis, and Harris (2006b) demonstrated that autonomous motivations for dieting positively predicted perceived behavioural control of dieting and adaptive attitudes, which predicted behaviour via intentions. This predicted pathway was also maintained when considering exercise as the outcome behaviour. Although a direct pathway from autonomous motives to intentions was only demonstrated with regard to exercise and not diet behaviour, which suggests additional cognitive processes are likely to also contribute to the relationship between autonomous motives and healthy eating behaviour outcomes (de Ridder, 2012).

2.2.2.2 Autonomous motivation and affective outcomes. With regard to affective outcomes, investigations with adolescents in school physical education settings have found more autonomous forms of motivation toward physical education to positively predict global self-esteem (Hein & Koka, 2007), positive affect (Standage et al., 2005), quality of life (Gillison, Standage, & Skevington, 2006), and to negatively predict maladaptive outcomes of these indices. Standage and colleagues (Standage & Gillison, 2007; Standage, Gillison, Ntoumanis, & Treasure, 2012) extended these findings to motivation related to both physical education and exercise settings external to school settings, and found higher levels of autonomous motivation in both settings positively predicted adolescents' health-related quality of life, general self-esteem, and physical self-concept. Similarly, more autonomous forms of motivation toward exercise have also been shown in adults to positively predict

psychological well-being (Sebire, Standage, & Vansteenkiste, 2009), physical self-worth (Sebire et al., 2009; Thøgersen-Ntoumani & Ntoumanis, 2006), and self-efficacy to overcome barriers to regular exercise (Thøgersen-Ntoumani & Ntoumanis, 2006). Specific to experiences of overweight and obese women (*n* = 139), Carraca et al. (2011) recently demonstrated that endorsement of controlled regulations for entering a behavioural weight management treatment was negatively associated with psychological well-being inclusive of self-esteem, vitality, social functioning, mental health, and emotional functioning.

Similar findings were further demonstrated in a longitudinal study of adults (n = 49) participating in a 3-month prescription exercise scheme (Edmunds, Ntoumanis, & Duda, 2007). Using multilevel regression analyses, results indicated intrinsic motivation was a positive predictor of positive affect and introjected regulation was a negative predictor of subjective vitality. Although these findings support the contention that autonomous regulations are associated with positive affective states, a recent meta-analysis examining mental health (and health behaviour) outcomes in health care and health promotion contexts demonstrated a positive relationship between introjected regulation and positive affective states (age >18 years and age <18 years; Ng et al., 2012). However, introjected regulations were also related to maladaptive outcomes (e.g., anxiety and depression), and the additional forms of regulations predicted outcomes in the hypothesised direction, which is consistent with the postulates of self-determination theory (Deci & Ryan, 2000). This suggests that introjected regulations may, in some instances, lead to engagement in behaviours perceived to be adaptive in the short-term, but which have long-term maladaptive effects, leading to less desirable states (Pelletier, Fortier, Vallerand, & Briére, 2001). Different regulations may also co-exist, making it possible for some degree of introjection to be present, although its existence may be weak in comparison to the

overwhelming presence of more autonomous regulations (e.g., integrated), in which case the impact of introjected regulations on long-term adherence is mitigated (Williams et al., 2011).

2.2.2.3 Autonomous motivation and behaviour outcomes. Similar to research exploring affective and cognitive outcomes, investigations have shown more autonomous behavioural regulations predict more positive behaviour outcomes. For instance, examining longitudinal changes in adolescents' (*n* = 310; *M* age = 14.08) leisure-time physical activity, Gillison, Standage, and Skevington (2011) found adolescent females classified as exercise maintainers (based on self-reported physical activity at baseline and follow-up) during a 10-month period were more likely to report endorsing intrinsic and identified motivations in comparison to their female counterparts classified as exercise drop-outs, initiators, and continually inactive. Whereas adolescent males classified as exercise maintainers reported greater identified and introjected regulations in comparison to their respective male peers (Gillison et al., 2011). The finding that introjected regulation was associated with male exercise engagement (Gillison et al., 2011) is aligned with findings from qualitative investigations, indicating adolescent males may initially engage in exercise to gain social recognition (Gillison, Osborn, Standage, & Skevington, 2009), but over a long-term period engagement based on introjected motives is likely to be associated with maladaptive outcomes (Deci & Ryan, 2008). For instance, longitudinal investigations of participation drop-out in competitive adolescent and young adult athletes have demonstrated drop-out in the long-term is positively associated with more controlling motivations at baseline assessment (Pelletier et al., 2001; Sarrazin, Vallerand, Guillet, Pelletier, & Cury, 2002). Cross-sectional investigations of overweight and obese adolescents (*n* = 105; *M* age = 15.0) have also demonstrated a positive relationship between more autonomous forms of motivation

(e.g., intrinsic, integrated, and identified) and reported weekly physical activity, and a negative relationship between more controlling forms of motivation (e.g., external regulation and amotivation) and weekly physical activity engagement (Gourlan, Trouilloud, & Sarrazin, 2013).

Objectively-assessed measures of physical activity have provided further support for the positive relationship between autonomous motivation and adaptive behaviour outcomes. For instance, using accelerometer data from a single session high school physical education class (*n* = 739; *M* age = 14.36; 29 classes from 49 schools), Aelterman et al. (2012) demonstrated that more autonomously motivated classes were more physically active and presented as more dedicated, enthusiastic, and engaged according to external observers (e.g., research team members). Taking in to account continued behaviour persistence during leisure-time (e.g., 7-day accelerometer), Owen, Astell-Burt, and Lonsdale (2013) found autonomous motivation toward leisure-time physical activity and physical education was correlated with physical activity in both settings. These findings were consistent with objective assessments conducted in university students (*n* = 55; *M* age = 22.27; 7-day combined heart rate and accelerometer), and children aged 7 to 11 years (*n* = 462; 5-day accelerometer), which found a positive relationship between autonomous motivation and time spent in moderate and moderate-to-vigorous intensity physical activity (Sebire, Jago, Fox, Edwards, & Thompson, 2013; Standage, Sebire, & Loney, 2008).

In the domain of healthy eating behaviour, using 3-day snack food diaries, Stok et al. (2010) demonstrated that adolescents (*n* = 105; *M* age = 14.63) who were "externally guided by others" (e.g., endorsed more controlled motives), compared to those more "internally controlled" (e.g., internally motived), with regard to snack food purchases, reported higher levels of unhealthy snack purchases. Similarly, in a sample of university

students (*n* = 101; *M* age = 21.65), perceptions of oneself as having a "healthy-eating identity" (e.g., identifying healthy eating as congruent with oneself) was positively associated with self-reported intake of fruits and vegetables and negatively related to intake of foods with a low nutrient value over a two-week period (Strachan & Brawley, 2009). These findings are in line with evidence from longitudinal studies demonstrating a positive association among autonomous motivation and weight status at 3-years post-entry to university (Morgan et al., 2012), as well as reductions in fat (dietary and saturated) and calorie intake in adults at 26-weeks post-reception of a dietary counselling session (Study 3; Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004).

Collectively, the current evidence-base supports the proposed relationship in self-determination theory, that more autonomous motivation is positively associated with adaptive outcomes (Deci & Ryan, 2000). Given autonomous motivation is shown to mediate the relationship between weight status and both cardiovascular fitness (Power, Ullrich-French, Steele, Daratha, & Bindler, 2011) and healthy eating behaviours (Leong, Madden, Gray, & Horwarth, 2012), a primary concern of interventionists has been the exploration of environmental factors responsible for fostering autonomous motivation for behaviour change (Deci & Ryan, 2008). The following section provides a review of studies investigating the contribution of environmental factors postulated in self-determination theory to foster behaviour engagement associated with autonomous motivation. Findings are then reviewed in the context of methods proposed in the current study for promoting adolescents' autonomous motivation to engage in physical activity and healthy eating behaviours.

2.2.3 Fostering autonomous motivation for behaviour change.

2.2.3.1 Autonomy support, structure, and involvement – introduction. Although individuals are postulated in OIT to have an innate tendency to integrate aspects of their

environment (Deci & Ryan, 2000), behaviours deemed necessary for social functioning and/or health purposes are not always intrinsically interesting and may require external motivation to occur at all (Deci, Eghrari, Patrick, & Leone, 1994). Behaviours in these instances may relate to those introduced by social agents (i.e., teachers, parents, doctors) that are laden with social pressures to perform, but which are necessary to begin the process of internalization (Grolnick, Deci, & Ryan, 1997). Applied within the health domain, support for this contention was demonstrated in a recent meta-analysis that showed adults who initiated and successfully maintained physical activity were typically characterised by external regulations at uptake and later motivated by internal regulations during maintenance of physical activity behaviours (Rodgers, Hall, Duncan, Pearson, & Milne, 2010). Similarly, using a mixed-methods approach, Gillison, Sebire, and Standage (2011) demonstrated increases in female adolescents' (*n* = 107; *M* age = 13.28 years) physical activity engagement over a 1-year period was associated with increased endorsement of intrinsic and identified motives for exercise at follow-up in comparison to their peers whose physical activity levels were not significantly variant from baseline.

In line with self-determination theory, mechanisms underlying such progressions toward more self-determined, or autonomous, regulations of health behaviours (e.g., internalization) have been shown to be a reflection of the degree to which need satisfaction is promoted within an individual's environment (Deci & Ryan, 2008). Need satisfaction is proposed to be achieved through environmental provisions of autonomy support, structure, and involvement (Reeve, Jang, Carrell, Jeon, & Barch, 2004).

Autonomy support includes the promotion of choice and limited use of controlling demands by providing choices for activities, being responsive to individuals' feelings and thoughts, and explaining rationale for activities (Edmunds et al., 2007). Autonomy support

directly supports autonomy and indirectly supports basic needs for competence and relatedness (Black & Deci, 2000). *Structure* provides direct support for competence (Reeve et al., 2004) and involves the provision of consistent guidelines for behaviour by providing optimally challenging tasks, assistance to formulate realistic goals, and positive feedback regarding progress (Reeve, 2002; Reeve et al., 2004). *Involvement* directly facilitates relatedness (Deci & Ryan, 1991; Reeve, 2002) and refers to social agents' display of support resources (e.g., physical, time) and interest in individuals' day-to-day pursuits.

Rationale for developing the current intervention will be provided through a review of the available evidence-base demonstrating the benefits of providing environments comprised of autonomy support, structure and involvement. Findings are differentiated in the following sections by the study design employed to investigate proposed relationships within the context of physical activity and healthy eating: observational studies (i.e., research exclusive of external influence or intervention), experimental studies (i.e., research that controls and/or accounts for extraneous factors), and intervention studies (i.e., studies attempting to change environmental factors in the context of a real-life setting). Observational studies are reviewed first to provide a foundation for the development of experimental, and more recently, intervention studies used to explore the hypothesized pathways proposed in self-determination theory. The application of these findings within the current study are then reviewed in the context of interventions seeking to modify environmental contexts to promote autonomous motivation for adolescents' healthy lifestyle behaviour changes.

2.2.3.2 Autonomy support, structure and involvement – Observational studies. A number of observational studies have provided support for the proposed benefits of providing autonomy support, structure, and involvement. In relation to perceptions of

autonomy support, using a sample of 369 competitive swimmers (*M* age = 15.6; age range 13 to 22 years), Pellietier, Fortier, Vallerand, and Brière (2001) employed a prospective three-wave design across a 22-month period to demonstrate the stability of the predicted relationships over the long-term. Perceptions of autonomy support from coaches (Time 1) was shown to be positively associated with autonomous forms of motivation, which positively predicted continued persistence in the sport at 10-months (Time 2) and 22-months (Time 3) (Pelletier et al., 2001). Investigating samples of high school students (*n* = 840) across four countries (e.g., Britain, Estonia, Finland, Hungry), Hagger et al. (2009) employed a three-wave design (5 week period) and demonstrated students' perceived autonomy support provided by physical education teachers indirectly predicted self-reported leisure-time physical activity via autonomous motivation. These findings corroborate cross-sectional research in adult samples, which have demonstrated that perceptions of autonomy support from friends (Wilson & Rodgers, 2004) and exercise class leaders (Edmunds, Ntoumanis, & Duda, 2006) positively predicts self-determined regulations, which in turn, predicts self-reported exercise behaviour.

In relation to healthy eating, choice in the availability of unhealthy (e.g., sweet and savoury) and healthy (e.g., fruit and vegetables) foods within the home environment has been shown to positively predict adolescent consumption for each respective food type (K. Campbell et al., 2007; Hanson, Neumark-Sztainer, Eisenberg, Story, & Wall, 2005). Perceptions of parental autonomy support have also been shown to have a negative indirect effect, via need satisfaction, on adolescents' unhealthy weight control behaviours (i.e., vomiting, skipping meals, fasting) (Thøgersen-Ntoumani, Ntoumanis, & Nikitaras, 2010), whereas perceived controlling parent feeding practices (i.e., restriction and pressure to eat) have been shown to positively predict increases in adolescent weight status (Loth,

MacLehose, Fulkerson, Crow, & Neumark-Sztainer, 2013). Importantly, effects of adolescents' perceptions of parent behaviours as autonomy supportive on adolescents' autonomous motivation for physical activity and dieting behaviours have been shown to endure once leaving home to attend university (Morrison, Dashiff, & Vance, 2013).

Alongside autonomy support, the importance of promoting involvement and structure to enhance outcomes has also been demonstrated in both physical activity and healthy eating contexts. Cross-sectional studies investigating high school students' perceptions of physical education teachers' provision of structure and involvement have shown perceptions of these behaviours to directly and indirectly (via need satisfaction) predict more autonomous motivation in physical education and leisure-time physical activity (Cox, Smith, & Williams, 2008; Dupont, Carlier, Gérard, & Delens, 2009; Ntoumanis, 2001), as well as intentions and self-reported leisure-time physical activity (Dupont et al., 2009), beyond perceptions of autonomy support (I. M. Taylor & Ntoumanis, 2007). Results of cross-lagged path analysis in a 1-year longitudinal study (n = 330; M age = 13.74 years) also revealed students' autonomous motivation is reciprocally related over time with perceived positive feedback and inclusive decision making provided by physical education teachers, and unidirectionally related at follow-up to teaching styles inclusive of taking the students' ability into account, prior situation consideration, and exhibiting interest and concern for students' welfare (Koka, 2013b).

External to physical education settings, parents' provision of structure and involvement through joint engagement and logistical support for physical activity has been shown to positively predict adolescents' physical activity participation (Timperio et al., 2013), self-efficacy, and self-esteem (Sebire, Haase, Montgomery, McNeill, & Jago, 2013) in cross-sectional studies. Parental encouragement for adolescents' physical activity has also

been shown over a 5-year period to be positively associated with adolescents' level of physical activity (Bauer, Nelson, Boutelle, & Neumark-Sztainer, 2008)

With respect to healthy eating, parents' provision and consumption (i.e., modelling leadership – structure) of unhealthy (i.e., take-out, sweet and savoury snacks) and healthy (i.e., fruits and vegetables) foods has been shown in cross-sectional studies to be associated with corresponding intake in adolescents (Bauer et al., 2011; K. Campbell et al., 2007). In addition, the structured act of planning and providing family meals has been shown to be associated with greater intake of fruits and vegetables in adolescents (Boutelle, Birnbaum, Lytle, Murray, & Story, 2003), frequency of communication between adolescents and parents (e.g., involvement) (Roblin, 2007), and frequency of family meals, which are shown to be associated with adolescent well-being (Eisenberg, Olson, Neumark-Sztainer, Story, & Bearinger, 2004) and BMI later in adulthood (Larson, Neumark-Sztainer, Hannan, & Story, 2007). Involvement and structure in the form of family cohesion, parental monitoring, and parental engagement have also been shown to be linked with lower levels of depressive symptoms and self-esteem (Ornelas, Perreira, & Ayala, 2007); whereas less structured environments that permit the skipping of meals, junk food intake, and irregular meal patterns have been associated with poorer psychological outcomes (Zahra, Ford, & Jodrell, 2013).

Despite a substantial body of evidence confirming the benefits of providing need-supportive environments across a diverse range of study participants, evidence suggests that in some instances perceptions of support can vary according to demographic variables. For instance, gender differences have been observed when assessing perceptions of need-supportive behaviours and satisfaction of needs within shared environmental contexts (Mandigo, Holt, Anderson, & Sheppard, 2008; Ntoumanis, 2005). In a cross-sectional sample

of adults from ethnically diverse backgrounds Edmunds, Duda, and Ntoumanis (2010) also found perceptions of need-support in exercise settings differentially predicted engagement depending on one's race. These findings suggest that although basic needs posited in self-determination theory are likely to be universal, in some instances, demographic factors may moderate the perceptions of one's environment as need-supportive.

2.2.3.3 Autonomy support, structure, and involvement – Experimental studies.

Experimental studies addressing health behaviour changes in adolescents have predominately been conducted in the context of physical activity behaviours, with less attention afforded to healthy eating behaviours. Within the context of physical activity, exposure to environmental manipulations has almost solely been explored within the context of physical education settings. The primary focus of these experimental studies in the health behaviour context has also been the manipulation of autonomy support, with minimal exploration of manipulations related to the provision of structure and involvement. For instance, in a recent meta-analysis examining self-determination theory in physical education settings, seven of the ten experimental studies identified addressed the sole provision of autonomy support (Van den Berghe et al., 2012). Manipulations of autonomy support were carried out through responsive and flexible teaching methods in which support was offered and rewards avoided (Mandigo et al., 2008), by increasing students' responsibility in decision making and ability to solve problems related to motor tasks (Moreno-Murcia, Lacárcel, & Álvarez, 2010), providing choice in activity selection (Ward, Wilkinson, Graser, & Prusak, 2008), and through manipulation of task instructions related to goal strivings (Simons, Dewitte, & Lens, 2003; Vansteenkiste, Matos, Lens, & Soenens, 2007; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004; Vansteenkiste, Simons, Soenens, & Lens, 2004).

Although effects were demonstrated for increased enjoyment (Mandigo et al., 2008), task orientation (Moreno-Murcia, Lacárcel, et al., 2010), autonomous motivation (Ward et al., 2008), and increased performance (Simons et al., 2003; Vansteenkiste, Matos, et al., 2007; Vansteenkiste, Simons, Lens, Sheldon, et al., 2004; Vansteenkiste, Simons, Soenens, et al., 2004), manipulations were carried out in relation to novel behaviours, and did not explore behaviour maintenance for pre-existing behaviours. In addition, findings indicated the limited ability of autonomy support alone to directly support all three needs (e.g., Moreno-Murcia, Lacárcel, et al., 2010). Notable, however, was the finding that exposure to choice followed by denial of choice, was associated with a reduction in autonomous motivation from baseline, compared to denial followed by choice, which was associated with increased autonomous motivation (Ward et al., 2008).

The remaining studies (Van den Berghe et al., 2012) focused on direct support for relatedness by manipulating teacher involvement (Radel, Sarrazin, Legrain, & Wild, 2010), and direct support for competence by manipulating positive feedback (Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008), and ability beliefs (Moreno-Murcia, González-Cutre Coll, Martín-Albo, & Cervelló, 2010). Manipulations were successful in promoting intrinsic motivation (Moreno-Murcia, González-Cutre Coll, et al., 2010), behaviour persistence (Radel et al., 2010), and higher levels of vitality and positive affect (Mouratidis et al., 2008). However, measures of need satisfaction indicated that targeting involvement and/or structure was not sufficient to satisfy all three needs (Deci & Ryan, 1991).

Extending the previous findings beyond experimental studies conducted in physical education settings (Van den Berghe et al., 2012), Peng, Lin, Pfeiffer, and Winn (2012) demonstrated manipulations of autonomy support and competence support in active video game play positively predicted enjoyment, need satisfaction, and motivation for future

game play, although no effects were demonstrated on self-reported effort expended. Assessing accelerometer-based measures of effort in response to manipulations of relatedness in video game play, Peng and Crouse (2013) later found participants engaged in relatedness conditions (e.g., same space and co-operative different spaces) were significantly more motivated to play in the future than those in the single player condition, although effort was greater in the single player condition than same physical space, which was likely confounded by participants' limited ability to move in the shared space condition (Peng & Crouse, 2013).

Experimental studies exploring the manipulation of environmental supports surrounding healthy eating behaviour have been limited in contrast to those evaluating physical activity. More specifically, the provision of need-supportive or needs-thwarting environments has been predominately focused on fruit and vegetable consumption in samples of children. For instance, Zeinestra (2010) randomly assigned children aged 4 to 6 years and their parents (n = 303) to one of three conditions, varied in the degree of choice offered and found no significant differences between conditions with regard to children's vegetable intake and liking, and enjoyment of meal atmosphere (Zeinstra et al., 2010). However, child intake was correlated with parent intake across all conditions, thus parent modelling may have confounded effects of the experimental conditions. Cooke et al. (2012) randomly assigned children aged 4 to 6 years (n = 344) to one of three conditions varied by the type of reward (e.g., praise, tangible, or neither) for tasting a less preferred vegetable on ten separate occasions and found at 3-month follow-up that intake levels were maintained in the verbal (e.g., autonomy-supportive) and material (e.g., controlling) reward groups compared to no-reward (Cooke et al., 2012). However, participants in the control condition were offered limited social interaction, which is more likely to have thwarted, rather than

supported their needs for relatedness, in comparison to the other two conditions (Deci & Ryan, 2000). Manipulations of choice were carried out in a sample of children and adolescents (8 to 15 years of age) by randomly allocating participants to a perceived choice in dietary treatment condition (*n* = 7) or no choice (*n* = 8) prior to enrolling all participants in the same 8-week treatment (Mendonca & Brehm, 1983). Results immediately following treatment indicated significantly greater decrease in weight for those assigned to the choice condition (Mendonca & Brehm, 1983). However, conclusions could not be drawn at 6-month follow-up due to high attrition (e.g., choice, *n* = 3; no choice, *n* = 8).

Although the previously-reviewed studies demonstrate the feasibility of experimentally manipulating need-support in the context of physical activity and healthy eating, a primary concern is the lack of environmental manipulations to directly support relatedness and competence alongside autonomy. Given needs for relatedness and competence have been shown to make unique contributions to individuals' degree of autonomous motivation (e.g., Shrewsbury, Steinbeck, Torvaldsen, & Baur, 2011), and in some instances have been shown to be a stronger predictor of engagement than autonomy (Ntoumanis, 2001), it is imperative to jointly explore direct support for autonomy, relatedness, and competence needs.

Failure to address competence and relatedness needs in conjunction with autonomy has important implications for individuals' behaviour engagement due to the limitations placed on individuals' capacity to optimise benefits gained from autonomy. For instance, adolescents may choose to engage in physical activity, but their perception of choice alone will not compensate for their lack of physical activity skills (e.g., competence), which may ultimately lead to behaviour disengagement (Cairney et al., 2012; Fairclough, Hilland, Stratton, & Ridgers, 2012). These findings are in line with the only experimental study to

individually manipulate provision of each need, which found optimal results were demonstrated when adults were exposed to board game instructions that directly supported all three needs compared to conditions directly supporting two or less needs (Sheldon & Filak, 2008). Together, these findings confirm the proposition within self-determination theory that direct support for all three needs is necessary for optimal functioning (Deci & Ryan, 2000), and should therefore be a primary concern of interventions seeking to change behaviour (Ryan, Rigby, & Przybylski, 2006; Sheldon & Filak, 2008). A review of how each type of need support has been provided within intervention studies is provided in the following sections (2.2.4 and 2.2.5) in the context of adolescent behaviour.

2.2.4 Modification of instructor behaviours to improve adolescent physical activity and healthy eating behaviours. Based on evidence provided in observational and experimental studies demonstrating the relationship among need-support, autonomous motivation, and behaviour engagement, the motivational climate surrounding the prescription of healthy lifestyle behaviours has become a key factor for interventions targeting the maintenance of long-term behaviour changes (Fortier, Duda, Guerin, & Teixeira, 2012). The primary avenue for eliciting adolescent behaviour changes via environmental mechanisms has, to date, been the modification of physical education teachers' demonstration of behaviours within school settings (Williams et al., 2011). Additional avenues explored to a lesser extent have included the modification of environments delivered by instructors external to school settings (i.e., inpatient intervention) and parents. The current section addresses the modification of instructor behaviours inclusive of physical education settings and external intervention settings. Given the importance of parent behaviours in fostering adolescents' autonomous motivation

(Hagger et al., 2009; Morrison et al., 2013), the modification of parent behaviours will be reviewed in a separate section (see section 2.2.5).

Interventions targeting modifications to instructor behaviours have varied in time commitment from training instructors to deliver single session programs to multiple sessions across school years. Similar to experimental studies (see Van den Berghe et al., 2012), a central focus has been the modification of behaviours to support autonomy, with less attention afforded to supporting needs for competence and relatedness. Initially examined within the context of classroom instruction, Reeve (1998) demonstrated sustained increases at 1-month follow-up in pre-service teachers' autonomy-supportive behaviours following exposure to a training booklet. Following on from these findings, Reeve, Jang, Carrell, Jeon, and Barch (2004) showed a positive relationship between teachers' receipt of training in autonomy-supportive techniques and displays of autonomy-supportive behaviours.

Expanding findings from classroom settings to the health domain, Tessier, Sarrazin, and Ntoumanis (2008) randomly assigned five physical education teachers from two junior high schools to either a control condition (n = 3) or attendance at an autonomy-supportive training (n = 2). Following an informational session presenting concepts and supportive evidence for self-determination theory and using an autonomy-supportive teaching style, teachers worked in groups to practice teaching in an autonomy-supportive teaching style (Tessier et al., 2008). Teachers then led physical education instruction in six gymnastics sessions for two hours in length over an 8-week period for classes of approximately twenty 12 – 19 year old students. During this time, instruction was filmed and feedback provided by the researchers using video footage that highlighted instances during the lesson where teaching styles could be improved to demonstrate more autonomy-supportive rather than

controlling instruction. Based on coding of video observations, teachers in the intervention condition demonstrated a greater frequency of autonomy-supportive teaching behaviours (Tessier et al., 2008). However, adolescents' motivation and engagement in physical education tasks were not measured; therefore, it is not possible to know if changes in autonomy-supportive teaching styles were associated with adolescents' reception of a more need-supportive environment and subsequent improvement in adolescents' behaviour outcomes.

Prior neglect with regard to the assessment of student perceptions of autonomy-supportive environments was more recently addressed in a study comparing the effectiveness of two interventions that varied in the degree of need support provided (Chatzisarantis & Hagger, 2009). The first intervention trained teachers to meet students' needs for autonomy, competence, and relatedness by providing rationale, feedback, choice, and acknowledge difficulties encountered in physical education classes, and the second intervention trained teachers to only provide rationale and feedback with the intent of primarily meeting needs for relatedness and competence. Physical education teachers (*n* = 10) recruited to participate were randomly assigned to either the control (less autonomy-supportive) or experimental (fully autonomy-supportive) condition and asked to demonstrate the respective teaching style during instruction over the five weeks following intervention (students aged 14 to 16 years; *n* = 215 at follow-up). Training for teachers in both conditions was carried out over three days, with each session lasting three hours in length (Chatzisarantis & Hagger, 2009).

Following the intervention, results indicated that teachers trained to be more autonomy-supportive were perceived by their students to demonstrate more autonomy-supportive behaviours (Chatzisarantis & Hagger, 2009). Students whose teachers were

taught to be more autonomy-supportive also reported greater changes in motivational orientations (i.e., more autonomous), stronger intentions to participate in leisure-time physical activity, and reported participating more frequently in leisure-time physical activity than adolescents taught by teachers instructed to use less autonomy-supportive teaching styles (Chatzisarantis & Hagger, 2009). Evidence of these between-group differences was thus instrumental in demonstrating the benefits of directly targeting all three needs.

Tessier, Sarrazin, and Ntoumanis (2010) further explored the benefits of training teachers to demonstrate behaviours to directly support all three needs. Three physical education teachers were recruited from separate high schools to attend a half day training following three video recordings of session instruction to determine their baseline levels of behaviours. Training introduced the basic tenets of self-determination theory and provided empirical evidence and physical examples of a need-supportive teaching style. Teachers were then asked to analyse their own teaching styles based on the previously recorded video footage, and given feedback on methods for improving delivery of more autonomy-supportive teaching behaviours. Teachers' behaviours were again filmed over the next three physical education sessions, and feedback provided by the researchers. Following recording of the last session, students from six classes (n = 185; M age =16.56) reported their levels of need satisfaction and motivational regulations in relation to their physical education class. Results indicated that receiving training in need-supportive behaviours was associated with improvements in teachers' demonstration of autonomy support, structure, and involvement according to rater observations (Tessier et al., 2010). In addition, students reported an increase in more self-determined forms of motivation and engagement in physical education tasks. However, analysis of need satisfaction revealed differences were only shown with regard to relatedness need satisfaction. Perceptions of school environments as

controlling may have influenced perceptions of autonomy support, whereas the duration of six sessions may have been too short to foster significant changes in competence need satisfaction related to existing behaviours.

Cheon, Reeve, and Moon (2012) argued that although these previous findings were informative, none explored longitudinal outcomes associated with training physical education teachers in need-supportive behaviours. More specifically, the researchers questioned whether physical education teachers' initial gains in capacity to deliver need-supportive behaviours were sustained overtime, or if they diminished as day-to-day pressures were drawn to the forefront. Cheon, Reeve, and Moon (2012) therefore assessed middle school and high school physical education teachers' (responsible for teaching five to seven classes with class sizes of 35 – 40 students) provision of autonomy-supportive behaviours and students' (*n* = 1,158) related outcomes at three points during the 6-month semester (e.g., beginning, mid-semester, and end of semester), following random allocation to the control (*n* = 10 teachers) or experimental (*n* = 9 teachers) group.

Experimental teachers attended training delivered at each data collection point, inclusive of a 3-hour workshop (T1), 2-hour presentation and information sharing session (T2), and a group discussion (T3) (Cheon et al., 2012). Descriptions and examples of autonomy-supportive teaching styles were provided alongside demonstrations (T1), followed by reinforcement of concepts through group discussions (T2) and sharing of ideas on how to provide autonomy-supportive teaching (Cheon et al., 2012). At mid-semester and end of semester (e.g., T2 and T3), rater observations of sessions showed teachers in the experimental group displayed significantly more autonomy-supportive behaviours in their instructions, and student reports of teaching behaviours found teachers in the experimental group were perceived to demonstrate more autonomy-supportive teaching styles compared

to those in the control group. In comparison to students taught by teachers in the control condition, students in physical education classes lead by teachers in receipt of autonomy-supportive training reported lower levels of amotivation and higher levels of need satisfaction, autonomous motivation, classroom engagement, perceived skill development, and intentions to participant in physical activity (Cheon et al., 2012). Gains in each of these outcomes was also greatest from T2 to T3, meaning students not only benefited from teachers' engagement in the mid-semester training, but that they continued to receive benefits through the end of the semester.

Cheon and Reeve (2013) later followed the same sample of physical education teachers in receipt of training (teacher *n* = 8; student *n* = 470) and a matched control group (teacher *n* = 9; student *n* = 483) to determine if need-supportive behaviours were maintained when leading a new group of students in the proceeding school year. Assessments conducted on the same variables at the start of the semester, mid-semester, and at the end of the semester indicated effects of training endured 1-year later (Cheon & Reeve, 2013). Students perceived physical education teachers in receipt of training to be more autonomy-supportive and less controlling than teachers in the control group, which was aligned with rater observations. With regard to adolescent outcomes, differences were present across all variables, and changes in variables were again greatest between T2 and T3 (Cheon & Reeve, 2013).

External to physical education settings, Verloigne et al. (2011) trained physiotherapists and physical education instructors to deliver components of a multi-disciplinary 10-month inpatient program for obese adolescents (*n* = 177; *M* age = 15.1) using the following behaviours: providing choice for activities, creating strong bonds with adolescents to encourage relatedness, and using small, realistic objectives to assist in

fostering experiences of success. Results showed increases in adolescents' autonomous motivation and physical activity following intervention (Verloigne et al., 2011); however, behaviours of the remaining multi-disciplinary team members (e.g., dietician and psychologist) involved in program delivery were not considered. Findings therefore could not necessarily be attributed to instructors' (e.g., physiotherapist and physical education) training in need-supportive behaviours. In addition, physical activity levels were assumed to be in line with prescribed exercises delivered during the intervention, and were not followed-up for assessment after completion. Despite best intentions for participants to follow the structured program routine, evidence suggests that adolescents in group settings do not necessarily engage in activities for the same duration and intensity levels, and thus the output of one adolescent cannot be assumed to be in line with another (Fairclough & Stratton, 2005; McKenzie, Marshall, Sallis, & Conway, 2000). Changes demonstrated during program sessions were also not likely to reflect the exact changes that adolescents demonstrated in their home environment following intervention (McKenzie, 2001), which is a more accurate measure of their behaviour maintenance (Fjeldsoe, Neuhaus, Winkler, & Eakin, 2011; Wadden, Butryn, & Byrne, 2004).

Exploration of instructor behaviour modification in interventions with adolescent samples suggests changes in health outcomes may be brought about through training instructors to be need-supportive. Despite the positive outcomes, studies in adolescent samples have to date been limited to the modification of instructor behaviours to support changes in physical activity, and have yet to explore healthy eating outcomes. Turning to interventions with adults, in an adult sample (*M* age = 46.3) recruited through churches, the Healthy Body Healthy Spirit Trial (Resnicow et al., 2002) explored the effects of motivational interviewing techniques in line with the tenets of self-determination theory (Resnicow et al.,

2005; Shaikh, Vinokur, Yaroch, Williams, & Resnicow, 2011). Participants were randomly assigned to one of three groups: Group 1 (*n* = 295) received existing commercial nutrition and physical activity intervention materials (comparison), Group 2 (*n* = 263) received culturally tailored self-help nutrition and physical activity intervention, and Group 3 (*n* = 367) received the same intervention as Group 2 with the addition of four 30 minute telephone counselling calls (two for nutrition and two for physical activity) using motivational interviewing techniques based on self-determination theory (Resnicow et al., 2002; Shaikh et al., 2011). Master's and doctoral level trained psychologists received 16 hours of initial training and 12 hours of ongoing training in motivational interviewing based on need-supportive postulates in self-determination theory (Resnicow et al., 2005).

Results at 1-year follow-up indicated no intervention effects for the comparison group (e.g., Group 1). Although participants in Group 2 demonstrated significantly higher levels of self-efficacy and autonomous motivation at follow-up, those in Group 3 demonstrated higher levels of autonomous motivation, social-support, fruit and vegetable intake, and social-support and self-efficacy mediated the effects on fruit and vegetable intake. Using a two-group structural model, participants in Group 3 with low baseline autonomous motivation were shown to have significant increases in autonomous motivation following intervention, whereas those high in autonomous motivation at baseline did not (Shaikh et al., 2011). The Group 3 intervention also had significant effects on fruit and vegetable intake in participants with high baseline controlled motivation, but no effect was shown on those with low baseline controlled motivation. Although perceptions of need-supportive behaviours were not assessed, demonstration of the ability for psychologists to change participants' outcomes in the hypothesised direction for autonomous and controlled motivations, as well as the associated fruit and vegetable

intake, suggests that health professionals can be trained to effectively modify individuals' healthy eating behaviour (Resnicow et al., 2005).

Expanding training in need-supportive behaviours to multi-disciplinary teams of instructors, interventions with adults suggest multi-disciplinary teams can be successfully trained to deliver need-supportive environments. For instance, in the delivery of the Promotion of Health and Exercise Obesity (PESO) trial, Silva and colleagues (Silva et al., 2011; Silva et al., 2008; Silva, Markland, et al., 2010; Silva, Vieira, et al., 2010) investigated longitudinal outcomes associated with training a multi-disciplinary team (inclusive of six physiologists, nutritionists/dieticians, and psychologists) in need-supportive behaviours to promote physical activity and healthy eating behaviour changes. Using a randomised control design, overweight and obese women (*n* = 239; *M* age = 37.6) were assigned to a 1-year program that meet weekly or bi-weekly (30 two hour sessions in total), which addressed general health education curriculum (e.g., control group) or promoted autonomous forms of regulation and intrinsic motivation delivered in line with self-determination theory and motivational interviewing techniques (e.g., intervention group) (Silva et al., 2008). Immediately following 1-year program involvement, participants in the intervention condition reported more autonomous self-regulation and intrinsic motivation for exercise, which was positively associated with perceptions of instructor need-support (Silva, Vieira, et al., 2010). Perceptions of need support and exercise autonomous motivation were also positively associated with psychological well-being, health-related quality of life, and self-esteem, and negatively correlated with depression and anxiety (Vieira et al., 2011). Furthermore, degree of autonomous motivation for exercise at 1-year follow-up positively predicted exercise at 2-year follow-up, and this was mediated by autonomous motivation at 2-year follow-up (Silva et al., 2011). The positive relationship demonstrated between receipt

of training in need-supportive behaviours, participants' perceived need-support, autonomous motivation, and positive affective and behavioural outcomes suggests that members of multi-disciplinary teams can be trained to effectively implement the full range of need-supportive behaviours (e.g., autonomy support, structure, and involvement) (Silva et al., 2011).

With reference to outcomes associated with healthy eating, results of the PESO trial found participants in the intervention, compared to controls, were shown to demonstrate higher self-efficacy and cognitive restraint, and lower disinhibition, emotional eating, and external eating scores (Mata et al., 2009). Further findings also indicated that intrinsic motivation for exercise had a positive "spill-over" effect on these measures of eating regulation. Consistent with previous demonstrations of a carry-over between intrinsic motivation in physical education contexts to leisure time contexts (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003), these findings suggest an interplay between contextual levels of motivation for healthy lifestyle behaviours (Mata et al., 2009). Given the health benefits of changing both physical activity and healthy eating (Wilfley et al., 2007), these findings indicate that self-determination theory can be a useful framework for informing interventions from a multi-disciplinary perspective. Although within the theory multiple behavioural pursuits are not articulated, there is currently a dearth of studies reporting on the successful application of theory to interventions targeting multiple behavioural pursuits (Prochaska, Spring, & Nigg, 2009). Further exploration of the application of self-determination theory to interventions from a multi-disciplinary perspective is therefore needed to inform the evidence base of motivational mechanisms underlying the well-established synergistic changes between physical activity and healthy eating behaviours (Mata et al., 2009).

Together, the previously reviewed studies indicate that adaptive outcomes are likely to be associated with instructors' receipt of training in need-supportive behaviours. Despite these promising findings, the scope of studies thus far has been limited to adolescents' physical activity behaviours, with the inclusion of healthy eating behaviours limited to adult samples. Targeting physical activity has been shown to reduce obesity, yet the benefits of engaging in physical activity are limited if efforts are not made to also modify motivations related to engagement in healthy eating behaviours (Stubbs & Lee, 2004). In line with targeting engagement in both physical activity and healthy eating behaviours, interventions led by a multi-disciplinary team have also been shown to be most effective (Spear et al., 2007), although training multi-disciplinary teams of instructors has thus far been limited to investigations with regard to outcomes in adults. Further research is therefore needed to explore the effects of training instructors from a range of disciplinary backgrounds to modify adolescents' physical activity and healthy eating behaviours. The current study sought to address previous shortcomings by investigating adolescents' physical activity and healthy eating behaviours over a 1-year period following an intervention comprised of multi-disciplinary teams of instructors (e.g., psychologists, physiotherapists, and dieticians), which aimed to provide training in need-supportive behaviours (e.g., autonomy support, structure, and involvement). Given the potential for synergistic changes between autonomous motivation on physical activity and healthy eating behaviours, expanding on the limited studies exploring the motivational mechanisms underlying this effect is necessary to enhance understanding of behaviour change across a range of healthy lifestyle behaviours within the context of self-determination theory (Eccles & Wigfield, 2002; Mata et al., 2009) .

2.2.5 Modification of parent behaviours to improve adolescent physical activity and healthy eating behaviours. In addition to motivation fostered by instructors (e.g.,

inclusive of physical education teachers), the context surrounding adolescents' engagement in healthy lifestyle behaviours has been shown to be optimised when considering motivational underpinnings within the home environment (Hester, McKenna, & Gately, 2010; Twiddy, Wilson, Bryant, & Rudolf, 2012). Physical education teachers' capacity to foster autonomous motivation in adolescents is well noted (e.g., Chatzisarantis & Hagger, 2009; Cheon et al., 2012); however, adolescents' ability to fully engage in autonomously motivated physical activity and healthy eating behaviours is likely to hinge on parents' demonstration of behaviours that extend adolescents' experiences of need satisfaction to home environments (N. Pearson et al., 2012). For instance, an adolescent may be autonomously motivated to eat fruit but this can only be actualized if a parent purchases fruit to be consumed (e.g., structure). Similarly, if a parent does not discuss (e.g., involvement) preferred food choices (e.g., autonomy support), allocation of tangible resources may not be aligned with healthy lifestyle behaviours unique to the adolescent, and behaviour disengagement is likely to result (Holsten, Deatrick, Kumanyika, Pinto-Martin, & Compher, 2012).

Although adolescents' perceptions of parental need support have been shown to negatively predict junk food consumption (Karimi-Shahanjarini et al., 2012) and BMI (Chiang & Padilla, 2012), and to positively predict autonomous motivation, physical activity engagement (Hagger et al., 2009; Pihu & Hein, 2007), as well as fruit and vegetable consumption (Chiang & Padilla, 2012), the development and evaluation of interventions aimed at modifying parent behaviour skills within this population is still in its infancy. In a recent meta-analysis, only seven interventions were identified that addressed modification of general parenting skills, or behaviour-specific parenting with regard to the primary aim of either the prevention or treatment of childhood or adolescent overweight and obesity

(Gerards, Sleddens, Dagnelie, de Vries, & Kremers, 2011). In addition, these studies were limited in the age of parents' offspring, despite search parameters including parents of children from 0 to 18 years of age. With the exception of one intervention focusing on infants, the remaining interventions addressed young children ranging in age from 4 to 13 years, and none focused primarily on parents of adolescents (Gerards et al., 2011).

Despite not addressing adolescents' engagement in healthy lifestyle behaviours, a promising finding among studies assessing parenting outcomes (e.g., Golley, 2005; Harvey-Berino & Rourke, 2003; Israel, Guile, Baker, & Silverman, 1994; Robertson et al., 2008) was the large effect sizes reported, indicating parent behaviour is in fact a modifiable behaviour in the context of healthy lifestyle behaviours. Studies investigating the difference between interventions focused only on general parenting versus an intervention aimed at general parenting alongside physical activity and nutrition education (e.g., Golley, Magarey, Baur, Steinbeck, & Daniels, 2007; Harvey-Berino & Rourke, 2003) have also consistently demonstrated superior outcomes when interventions were inclusive of general parenting skills and healthy lifestyle components. However, of studies meeting the inclusion criteria (Gerards et al., 2011), modification of parent behaviours in the context of childhood obesity was only addressed using methods based on social learning principles (e.g., Golley, Magarey, et al., 2007; Golley, Perry, Magarey, & Daniels, 2007; West, Sanders, Cleghorn, & Davies, 2010). While some behaviours within this theoretical framework are aligned with principles within self-determination theory, the range of behaviours promoted did not map fully on to those needed to foster autonomous motivation according to the tenets of self-determination theory. For instance, West et al. (2010) encouraged parents to provide choice between healthy foods and to set rules regarding soft drink consumption; however, rewards

for healthy behaviours were also promoted and a focus on discussing children's experiences, or involvement, was not specifically promoted.

Since the meta-analysis conducted by Gerards et al. (2011), a limited number of studies have emerged with the aim of training parents in need-supportive behaviours to enhance healthy lifestyle behaviour engagement in children and adolescents. In a pilot study consisting of five weekly sessions, Kitzman-Ulrich et al. (2011) randomly assigned adolescents (ages 11 to 15 years) and their parents to a basic health intervention (*n* = 11 parents; 14 adolescents) or a motivational plus family weight loss intervention (*n* = 9 parents; 9 adolescents) targeting adolescent involvement in decision making, rule setting, and dietary education (i.e., strategies for cutting calories). In line with cognitive dissonance theory, family videos were also used in the motivational intervention to discuss positive coping strategies for diet and physical activity (Kitzman-Ulrich et al., 2011). Parent-only topics addressed in a single session were reflective of some aspects of providing need-supportive environments, although the full range of behaviours encompassing autonomy support, structure, and involvement were not addressed in their entirety. In addition, parents were not provided with additional intervention content to provide feedback on their implementation of these behaviours, nor did they receive further demonstration of how these need-supportive fit within the context of broader intervention components.

Results immediately following intervention did however demonstrate that adolescents of families in the motivational intervention reported significantly higher levels of daily fruit intake and motivation for diet and physical activity (Kitzman-Ulrich et al., 2011). Although promising, motivation was measured using scales based on social cognitive theory, and may not generalize to autonomous motivation postulated within self-determination theory. In addition, physical activity levels were not assessed and no significant differences

were found for vegetable intake or improvements in parenting style and parent support for physical activity and healthy eating (Kitzman-Ulrich et al., 2011). However, scales assessing parent behaviours were limited to the assessment of organization, nurturing/permissiveness, control, encouraging/sabotaging behaviours, and positive/negative feedback, which are not directly aligned with the need-supportive behaviours posited in self-determination theory. Furthermore, no details were provided in relation to instructor recruitment or training administered for the instructor, which limits the generalizability of these findings.

St. George et al. (2013) more recently randomized adolescents and their parents to jointly attend a 6-week (1.5 hour sessions, weekly) general health education intervention (*n* = 30, post-intervention) or an interactive parent-based intervention (*n* = 33, post-intervention) aligned with the integration of self-determination theory (Deci & Ryan, 2000), social cognitive theory (Bandura, 1986), and family systems theory (Broderick, 1993). Graduate students in psychology and public health were trained to deliver the intervention, although specific aspects related to autonomy support were reported in a grouped mapping of behaviours from all three theories, thus making it difficult to clearly delineate behaviours designated to promote autonomy support in line with the tenets of self-determination theory. Overall emphasis was however placed on adolescent-caregiver communication skills specific to health behaviours, which aligns with aspects of need-supportive environments, but does not necessarily encompass all the necessary behaviours to promote full internalization of a behaviour (Deci & Ryan, 2000).

Results of the study indicated that intervention participants reported significantly more positive parent-adolescent communication, parental monitoring (of sedentary behaviour), and lower levels of adolescent sedentary behaviour time at post-intervention

(St. George et al., 2013). Hierarchical regression analysis further demonstrated an interaction between parent-adolescent communication and sedentary behaviour, but parent monitoring was not a significant predictor of sedentary behaviour time (St. George et al., 2013). Although parent monitoring is a form of providing structure, in contrast to scheduling physical activities, imposing restrictions may be perceived as controlling, which is likely to have undermined attempts at providing autonomy support. Measures were also limited in their scope of assessing need-supportive behaviours, and thus the specific contribution of training in behaviours based on the tenets of self-determination theory cannot be generalized. Measures also failed to accurately assess adolescents' perceptions of parental behaviours. In addition, although physical activity and healthy eating were also targeted within the intervention, behaviour outcomes for these variables were not reported and thus the relationship between parents' receipt of training and adolescents' engagement in physical activity and healthy eating behaviours cannot be gauged. Further, the integration of additional theories (e.g., family systems theory and social cognitive theory), to that of self-determination theory, limits the generalizability of findings to training parents in environmental supports specific to need-supportive behaviours proposed in self-determination theory. Generalizability of these findings to community settings is also limited due to the program delivery and recruitment of instructors remaining university-based.

The only study to date to assess the feasibility of delivering a self-determination theory-based parent training program in a community setting was conducted with parents (n = 75) of children (ages 6 to 8 years) randomly assigned to enrol in eight weekly intervention sessions or the control group (Jago et al., 2013). Intervention topics addressed the provision of parent behaviours to support autonomy, competence, and relatedness.

Results indicated that children of parents in the intervention condition that completed the trial (*n* = 22) engaged in less TV viewing time at post-intervention and at 16-week follow-up compared to children in the control group (*n* = 11), although the differences were less marked at follow-up (Jago et al., 2013). Differences in 7-day accelerometer-based measures of moderate-to-vigorous physical activity were also demonstrated immediately following intervention, although these differences were no longer present at follow-up assessment. Similar differences were also reported at both post-program assessments with regard to parent behaviours for TV viewing and moderate-to-vigorous physical activity (Jago et al., 2013). Although these findings offer insight into physical activity outcomes associated with parenting training specific to methods from self-determination theory, the findings are limited to young children and may not generalize to adolescents. Furthermore, the intervention was delivered by research team members who relied on previous training from an external parent training organisation, *Family Links*.

The previously reviewed studies indicate that parents' receipt of training in behaviour methods is associated with adaptive health behaviour outcomes in children and adolescents. However, studies addressing adolescent healthy lifestyle behaviours included the integration of concepts from social cognitive theory and social learning theory and could not be easily mapped on to the specific behaviours proposed in self-determination theory to promote adolescents' internalization of behaviour motivations. In relation to parents' demonstration of need-supportive behaviours, changes in adolescents' motivation for physical activity and healthy eating behaviours have only been measured in accordance with social cognitive theory (e.g., Kitzman-Ulrich et al., 2011), which may not be consistent with the types of motivation posited within self-determination theory. Further investigation is therefore required to fully understand how intervention processes are applied in relation to

parent training, and in particular, how they relate to adolescent/parent dyads in predicting adolescents' autonomous motivation with regard to healthy lifestyle behaviour outcomes.

The current evidence-base specific to adolescent outcomes is also limited in scope due to the lack of studies that have addressed the relationship between parent training in need-supportive behaviours and adolescent physical activity. Adolescent outcomes have only been assessed in relation to healthy eating (Kitzman-Ulrich et al., 2011) and sedentary behaviour (St. George et al., 2013), and neither study examined longitudinal outcomes for adolescents. Whilst Jago et al. (2013) addressed these limitations in their examination of physical activity and training specific to self-determination theory concepts, the findings were limited to parents of 6 to 8 year olds and the 'maintenance period' was limited to a 2-month lapse of time since intervention completion.

Available evidence is also remiss of assessments exploring parents' demonstration of need-supportive behaviours. More specifically, effects of parent training on adolescents' behaviour engagement have yet to be assessed in relation to adolescents' perceptions of support and parents' reports of behaviour demonstrations in line with the tenets of self-determination theory. Thus, it is not possible to know if previously-demonstrated intervention effects were specific to changes in parents' need-supportive behaviours. Given the proposed importance of providing need-support in the home environment (e.g., Jago et al., 2013; Kitzman-Ulrich et al., 2011), it is imperative to assess whether programs aimed at training parents in need-supportive behaviours do indeed deliver environmental changes for adolescents.

Consistent with evidence regarding modification of instructor behaviour, adolescents are likely to receive the greatest benefits when parent behaviours are modified to directly support autonomy, competence, and relatedness (Van den Berghe et al., 2012). The current

intervention therefore sought to train instructors to deliver program components aimed at teaching parents to provide home environments inclusive of autonomy support, structure, and involvement to enhance adolescents' autonomous motivation and sustained engagement in physical activity and healthy eating behaviours. By training parents in these behaviours, it was proposed that adolescents would be provided an environment that would allow them to maximise outcomes resulting from autonomously motivated behaviours fostered during intervention instruction.

Exploring relationships among adolescents' autonomous motivation, perceived parent support, physical activity, and healthy eating behaviours contributed to the current literature by understanding the mechanisms underlying adolescents' engagement in healthy lifestyle behaviours within the context of the home environment. To date, the only study to explore the predicted path, following intervention (e.g., training in need-supportive behaviours), from perceived support to health behaviour outcomes through adolescent autonomous motivation was conducted in physical education settings (Chatzisarantis & Hagger, 2009). Although findings failed to support the hypothesised indirect pathway, only perceptions of autonomy support were measured and notable shortcomings in the adapted measurement tool (Learning Climate Questionnaire; Williams, Saizow, Ross, & Deci, 1997) were noted by the authors. As such, it is necessary to examine the hypothesised relationships using a valid and reliable measure of perceived need-support, inclusive of autonomy, structure, and involvement, and to expand the exploration of these relationships to parent behaviours following intervention.

Lastly, the current study further contributed to understanding adolescents' psychological functioning associated with training parents in need-supportive behaviours by exploring adolescents' associated health-related quality of life and depressive symptoms. Of

the studies directly investigating the feasibility of training parents in need-supportive behaviours to enhance healthy lifestyle behaviour engagement in their offspring (e.g., Jago et al., 2013; Koulouglioti et al., 2013), none have reported on associated psychological outcomes, despite substantial evidence demonstrating a positive relationship between autonomous behavioural regulations and psychological outcomes (Ng et al., 2012; Thøgersen-Ntoumani & Ntoumanis, 2006). Changes in affective outcomes are particularly salient for overweight and obese adolescents who more frequently report lower indices of these outcomes in comparison to their normal weight peers (Biddle, Fox, & Boutcher, 2000; Zeller, Roehrig, Modi, Daniels, & Inge, 2006).

Reported levels of health-related quality of life and depressive symptoms were hypothesised in the current study to improve following parents' receipt of training in need-supportive behaviours. Adolescents' perceptions of parent support were also hypothesised to predict changes in adolescents' health-related quality of life and depressive symptoms, and this relationship was further hypothesised to be mediated by changes in adolescents' autonomous motivation for physical activity and healthy eating. Although the proposed pathway has been examined in relation to predicting behaviour outcomes (Chatzisarantis & Hagger, 2009) in the physical education domain, no studies have explored this relationship with regard to changes in psychological outcomes associated with changes in perceptions of parents' support behaviours.

In line with the tenets of self-determination theory, following exposure to need-supportive environments delivered by instructors, parents were also proposed to undergo improvements to their degree of self-determined motivation underlying their engagement in behaviours to support adolescents' behaviour changes. In addition, following exposure to intervention environments, parents were proposed to be more autonomously motivated to

engage in need-supportive behaviours to support adolescents' engagement in physical activity and healthy eating behaviours. As a result of increased autonomous motivation, parents were further hypothesised to engage in more need-supportive behaviours, which in turn would be positively associated with changes in adolescent perceptions of parents as more need-supportive as well as changes in adolescents' engagement in healthy lifestyle behaviours. Although these propositions are consistent with self-determination theory, and direct relationships between autonomous motivation and provision of need-supportive behaviours have been supported in the literature, outcomes have only been explored in cross-sectional studies in relation to physical education teachers and sports coaches (i.e., Rocchi, Pelletier, & Lauren, 2013; I. M. Taylor & Ntoumanis, 2007; Van den Berghe et al., 2013). Further, no studies have explored the indirect relationship from autonomous motivations of significant others to adolescents' outcomes for healthy lifestyle behaviours.

2.2.6 Summary (self-determination theory). Substantial evidence has provided support for the proposed relationship in self-determination theory between individuals' environmental supports and the uptake of adaptive behavioural responses such as the adoption and maintenance of healthy lifestyle behaviours. Through the provision of autonomy support, structure, and involvement, intervention instructors as well as parents are postulated to foster adaptive outcomes for adolescents. The current study therefore trained instructors to deliver these need-supportive behaviours and explored whether instructors could then train parents to continue demonstration of these behaviours in home environments. Outcomes associated with instructor and parent training in need-supportive behaviours were proposed in the current study to enhance adolescent behaviour outcomes for physical activity and healthy eating as well as psychological outcomes inclusive of health-related quality of life and depressive symptoms.

Adolescents' engagement in healthy lifestyle behaviours was further posited to be enhanced when methods from goal setting theory were implemented. Methods from goal setting theory are reviewed in the following section, followed by a description of how the two theories (e.g., goal setting theory and self-determination theory) were integrated to maximize adolescents' engagement in healthy lifestyle behaviours.

2.3 Goal Setting Theory

2.3.1 Overview. In addition to self-determination theory, theories of goal setting have been applied to explain motivation for task performance. Based on decades of research in workplace settings, the most prominent goal setting theory was developed by Locke and Latham (1990) for purposes of motivating employee behaviour, and has since been widely applied to health behaviour (Shilts et al., 2013). Within the traditional goal setting framework proposed by Locke and Latham (1990), a goal is defined as the object or aim of an action. Applied to health behaviour, a goal might be a level of behaviour to attain, such as walking 30 minutes a day on weekdays.

Goal setting has been shown to be an effective method for promoting long-term behaviour engagement through the provision of a structure for developing and implementing behaviour-change plans that are posited within goal setting theory to activate motivational mechanisms responsible for behaviour engagement (Locke & Latham, 1990). Although studies from a self-determination theory perspective have shown autonomous motivation can engender behaviour engagement and persistence (e.g., Silva et al., 2011), it is likely that providing individuals need-support alongside structured techniques (e.g., goal setting) for implementing autonomously motivated behaviours will further assist in promoting sustained behaviour change (de Vet, Oenema, & Brug, 2011; Reuter, Ziegelmann, Wiedemann, & Lippke, 2008). More specifically, goal setting theory complements self-

determination theory by providing specific evidence-based techniques for implementing components necessary for the provision of structure (i.e., optimally challenging tasks, formulation of realistic goals, and positive feedback on progress).

Despite the benefits of targeting need-supportive environments alongside a motivational structure for implementing behaviour-change plans, studies to date have yet to integrate the two theories in a healthy lifestyle intervention. Rationale for the inclusion of goal setting methods will be further detailed in the current section by outlining theory-based concepts followed by a review of evidence demonstrating the effectiveness of goal setting as a behaviour change strategy for physical activity and healthy eating. In line with intervention components based on self-determination theory, adolescents, as well as their parents, were asked in the current study to make changes to their behaviours (e.g., adolescent healthy lifestyle behaviours, parent behaviours to support adolescents' healthy lifestyle choices). The following review of goal setting processes therefore addresses outcomes associated with experiences from both the adolescent and adult perspective.

2.3.2 Characteristics of goal setting.

2.3.2.1 Goal properties/techniques. Based on reviews from the industrial organisational literature (e.g., Locke & Latham, 1990; Locke, Shaw, Saari, & Latham, 1981), determinates of the effects of goal setting on task performance were proposed by Locke and Latham (1990) to be derived from the following goal properties, or techniques: difficulty, specificity, and proximity.

Goal difficulty. Difficult goals refer to the setting of goals that are challenging, but achievable, and stand in contrast to easy goals (Locke & Latham, 2013). A linear relationship between goal difficulty and performance is proposed within goal setting theory, such that more difficult goals are associated with higher performance levels (Locke & Latham, 1990),

although the predicted pathway from goal difficulty to performance is no longer maintained when a goal is too difficult, or exceeds one's ability (Locke, Cartledge, & Koeppel, 1968).

Goal specificity. Specific goals are in contrast to vague or "do your best" conditions, and require one to provide specific details for set goals, such as the amount and frequency of a behaviour (Locke et al., 1968).

Goal proximity. Proximal goals refer to short-term goals, which are broken down from long-term, or distal goals (Locke & Latham, 1990). Benefits of specific and difficult goals are shown to be further enhanced when set within a goal hierarchy system that includes both proximal and distal goals (Locke & Latham, 2002). Distal goals reflect more general goals to achieve in the long-term and are often too distant to inspire motivation on their own (Bandura, 1991). Proximal goals on the other hand refer to the series of subgoals created to achieve in the process of striving for a distal goal (Zimmerman, 2000). In other words, proximal goals serve as smaller more manageable steps to work toward on the path to attaining one's long-term goal (Donovan & Williams, 2003). Consequently, proximal goals appear more "real" and accessible than the more distal, or global goals contrived for long-term achievement (Bandura & Schunk, 1981).

2.3.3.2 Mechanisms of goal setting. Set goals that include difficulty, specificity, and proximity are posited within goal setting theory to effect performance via three motivational mechanisms: effort, persistence, and direction (Locke & Latham, 1990).

Effort. The first mechanism, effort, is activated once a goal is set and an individual starts working toward the nominated goal. The degree of effort enacted has been shown to vary in proportion to goal difficulty, such that more difficult goals are met with a greater degree of effort (Locke et al., 1968; Mento, Cartledge, & Locke, 1980). Heightened effort levels are shown to persist until goals are achieved because of the greater degree of work

invested to attain set goals (Ivancevich, 1976; Terborg, 1976; Terborg & Miller, 1978). By setting smaller tasks to achieve (e.g., proximal goals), individuals are also cued in to devote resources and efforts toward the task, which allows progress to be made and subsequent effort reinforced (Bandura & Cervone, 1986).

Persistence. The amount of time invested in achieving a goal, or one's behavioural persistence, is shown to increase when goals are set (Bandura & Schunk, 1981). Setting more difficult goals has been shown in meta-analyses across domains to lead individuals to persevere longer toward achieving their goals compared to set goals that are easy (Klein, Wesson, Hollenbeck, & Alge, 1999; Klein, Wesson, Hollenbeck, Wright, & DeShon, 2001). In addition, by setting specific proximal goals, ambiguity for assessing performance is reduced (Locke & Latham, 1990), which has been shown to lead people to continue investing time in working toward their goal more than when setting easy or general "do your best" goals (Locke & Latham, 1990; Reynolds & Anderson, 1982; Reynolds, Standiford, & Anderson, 1979). These differences are postulated to result from competence instilled following more frequent achievement, which fosters motivation to persist in goal behaviours, whereas vague goals are instead associated with failure (Rudisill, 1989), which negatively impacts on self-efficacy and produces a negative cyclical effect on persistence and subsequent performance (Bandura, 1989). Self-efficacy refers to individuals' beliefs that they possess the necessary knowledge and skills to successfully perform the goal behaviour (Bandura, 1986). Individuals with high self-efficacy beliefs are more likely to believe they can successfully attain goals in comparison to those with low self-efficacy beliefs who perceive they are likely to fail in reaching their goals. As a result, people with high self-efficacy are more likely to initiate and persist in the presence of challenges (Bandura & Wood, 1989), which is associated with greater performance (Donovan & Williams, 2003). Individuals low

in self-efficacy are easily discouraged and perceive any attempts would be futile when experiencing difficulties, and therefore quickly abandon the task rather than persist at the task at hand (Vancouver, Thompson, & Williams, 2001).

Direction. The third mechanism, direction, orients one's attention and effort toward goal-related activities and away from distractions or irrelevant activities (Rothkopf & Billington, 1979). Individuals are also oriented toward activating their knowledge and skills necessary for goal attainment (Locke & Latham, 1990). When set goals are specific, motivational mechanisms directing one's attention and efforts is intensified and goal achievement attained. For instance, a specific goal to "walk to school on Monday" is less ambiguous than "I will be active one day this week", and therefore directs a person's cognitive resources to focus on means for achieving the goal, such as waking up ten minutes earlier on the respective day to ensure enough time is allocated for the walk (Gollwitzer & Sheeran, 2006; Parks-Stamm, Gollwitzer, & Oettingen, 2007; Webb & Sheeran, 2007). Directional shifts achieved through goal setting have been supported by a number of experimental studies across a range of domains (Locke & Bryan, 1969; Reynolds & Anderson, 1982; Reynolds et al., 1979; Rothkopf & Billington, 1979; Terborg, 1976).

2.3.3 Goal setting theory applied to health behaviour. Locke and Latham (1985) argued that principles of goal setting could be even more effective in sports than in organizations, since measurement of individual's performance is typically more objective in sports than in industrial organizational settings. Locke and Latham's (1985) proposition has been extensively reviewed in the sport and exercise literature, with initial systematic reviews of the literature (e.g., Burton, 1994; Weinberg, 1992, 1994) finding equivocal support for use of goal setting in sport and exercise. Weinberg (1992, 1994) argued that goal setting may not have an impact on sport participants who are already highly motivated.

Further, studies in sport settings may not be able to control for spontaneous goal setting (i.e., "do your best"/control group conditions), which is more likely to occur in sport settings (Weinberg, 1992, 1994). Kyllo and Landers (1995) instead suggested that the inconsistent findings were due to low sample sizes in previously conducted studies. To determine if power was indeed the issue, Kyllo and Landers (1995) conducted a meta-analysis of literature from sport, exercise, and motor performance domains and found a meaningful effect size (Hedges' g) of 0.34 when goals were set. More recent meta-analyses have also provided support for the use of goal-setting as an effective strategy to promote physical activity and healthy eating behaviours (Greaves, 2011; Burton, 2008). Despite these findings, less consistent results have been reported when considering the effectiveness of individual goal properties proposed to enact motivational mechanisms within goal setting theory (Duda, 2004; Weinberg, 1994). Findings are reviewed in turn below with respect to goal difficulty, specificity, and proximity within the context of healthy lifestyle behaviours.

2.3.3.1 Goal difficulty. Findings from both the physical activity and healthy eating literature suggest benefits are greatest when goals of an optimum level of difficulty are enacted, rather than those with a high degree of difficulty. While this appears in contrast to Locke and Latham's (1990) proposition that more difficult goals lead to increased performance, a consistent shortcoming of the proposed relationship is the lack of a clearly defined measure of goal difficulty. Locke (1968) first defined goal difficulty as the percentage of trials on which the subjects trying for a particular goal actually beat that goal. In a later review, Locke, Shaw, Saari, and Latham (1981) defined goal difficulty as a certain level of task proficiency measured against a standard. However, the standard against which task proficiency should be measured was not defined. Locke, Chah, Harrison, and Lustgarten (1989) more recently defined goal difficulty as the probability that a goal can be reached,

and suggested that difficult goals be set at a level that only 10% of subjects could reach. Finally, Locke and Latham (1990) distinguished between objective goal difficulty (levels of goals) and subjective goal difficulty (individuals' assessment of goal difficulty), but noted a preference for objective goal difficulty. Although Locke and Latham (1990) suggested that in instances of using subjective difficulty, individuals could be encouraged to report their perceived degree of goal challenge to ensure goal difficulty.

In addition to the lack of consensus for the definition of goal difficulty within Locke and Latham's (1990) goal setting theory, a notable shortcoming is the lack of description for how goal difficulty should be applied to contexts external to workplace settings. Given the discrepancy in defining goal difficulty within Locke and Latham's (1990) goal setting theory, as well as other proposed definitions from additional goal theorists, Wright (1992) suggested goal difficulty be measured according to the degree to which a goal deviates from an individual's capacity to achieve the goal. Interpreting findings from the physical activity and healthy eating domain in the context of Wright's (1992) definition of goal difficulty therefore suggests the proposed motivational mechanisms enacted within Locke and Latham's (1990) goal setting theory, are indeed engaged when goals of optimum difficulty are set.

For instance, in Kyllo and Lander's (1995) meta-analysis, results demonstrated a meaningful effect size for moderately difficult goals (Hedges' g = 0.53) in predicting performance in comparison to improbable (-0.01), very difficult (0.09), and easy (0.07) goals. Since the meta-analysis, studies have continued to demonstrate more consistent support for optimal levels of goal setting rather than very difficult goal setting. For instance, in a sample of high school students (*n* = 346; *M* age = 15.32), assignment to difficult/realistic goals was associated with the greatest increases in performance on a sit-up task, followed

by easy goals (Bar-Eli, Tenenbaum, Pie, Btesh, & Almog, 1997). Whereas improbable/unattainable goals were associated with significantly less performance compared with difficult/attainable goals at four and six weeks, but not at eight weeks. Participants in the difficult/realistic group and the easy goal group demonstrated slight decreases at eight weeks, although the authors concluded these findings were likely due to participants already having reached their maximum capacity, which left little room for continued improvement (Bar-Eli et al., 1997).

Interviews conducted with coaches of high school (Weinberg, Butt, & Knight, 2001) and university (Weinberg, Butt, Knight, & Perritt, 2001) athletes revealed that goals perceived by coaches as unrealistic/too difficult to achieve created pressure and feelings of frustration in athletes. Further, unrealistic goals were suggested to create a sense of failure in athletes due to the inability to meet goals. Coaches instead reported making efforts to set goals that were difficult for the athlete, but that were realistic and attainable. Coaches reported drawing on their previous experience with athletes and assessment of the current athlete's performance to set goal difficulty, which was then continually monitored to ensure difficulty was not too high, and instead set at an attainable but challenging level (Weinberg, Butt, & Knight, 2001; Weinberg, Butt, Knight, et al., 2001).

Among the limited studies arguing performance is greatest when very difficult goals are set, positive outcomes have still been demonstrated when set goals were optimal, or challenging. Lerner and Locke (1995), for example, demonstrated that university males assigned to both the medium and high difficulty groups performed significantly better on a sit-up task than those in the "do your best" condition. In a perceptual speed trial, Jones and Cale (1997) demonstrated effort and task performance were significantly greater than controls when set goals were "challenging" and "very hard" compared to easy goals. A

notable finding however was the demonstration of greater errors and anxiety levels as well as reduction in self-confidence and effort in the very hard goals trial when compared to the challenging goals trial (Jones & Cale, 1997). Goudas, Ardamerinos, Vasilliou, and Zanou (1999) also argued that the greatest level of improvement in a motor time trial was shown in university students assigned to the difficult goals condition, compared to those assigned to easy goals, no goals, or to set personal goals. However, the challenging/optimal level of goal difficulty was not assessed.

Examination of goal difficulty in the healthy eating domain has been limited in comparison to studies conducted in the sport and exercise literature. Although meta-analyses have explored the effectiveness of goal setting as a behaviour change method for fostering healthy eating changes (e.g., Greaves et al., 2011; Shilts, Horowitz, & Townsend, 2004), none have assessed the specific contribution of setting difficult goals. Studies using methods from goal setting theory have, however, examined outcomes associated with varying levels of assigned dietary restrictions. For instance, Burke, et al. (2006) assigned adults (n = 200; M age = 44.1) to either the standard behaviour treatment with or without the addition of a lacto-ovo-vegetarian diet. Results indicated that one-third of participants assigned the additional task of eating a vegetarian diet failed to adhere to the dietary requirements at 6-month follow-up, which was associated with greater perceived difficulty in adherence. Consistent with these findings, McManus, Antinoro, and Sacks (2001) found that only 20% (n = 10/51) of overweight adults assigned to a low-fat diet group were actively participating in the weight loss program after 18 months, compared to 54% (n = 27/50) in the moderate-fat group ($p < 0.002$). These findings suggest that goals of optimal difficulty are perceived as more accessible and therefore foster behaviour engagement, compared to

goals perceived as “too difficult” or “very hard” (Consolvo, Klasnja, McDonald, & Landay, 2009).

In accordance with Locke and Latham’s (1990) suggestion that subjective goal difficulty be measured by asking individuals to report their perceived degree of goal challenge, the current study sought to ensure set goals enacted necessary motivational mechanisms by asking participants to report their perceived level of goal difficulty using a 1 (*very easy*) to 10 (*very difficult*) scale. Participants were encouraged to consider setting personal goals perceived to be a 6 to 8 on the goal difficulty scale to ensure set goals were challenging but not too difficult.

2.3.3.2 Goal specificity. A number of studies have provided support for the effectiveness of setting specific goals within the domain of healthy lifestyle behaviours. For instance, in a sample of regularly active university students (*n* = 85; *M* age = 20.1), Frahm-Templar, Estabrooks, and Gyursik (2003) found degree of specificity in personal exercise goals set for duration, intensity, frequency, and activity type positively predicted reported levels of exercise. Positive outcomes associated with objective measures of goal specificity were also demonstrated in a recent meta-analysis on the effectiveness of pedometer-based interventions, which found that having a specific step count goal (i.e., walk a minimum of 10,000 steps everyday) was associated with significant increases in physical activity (Bravata, Smith-Spangler, Sundaram, & et al., 2007). Results of secondary data analysis from a larger randomized-control trial (*n* = 342 of the full 709 sample; age range 18 to 65 years), in which participants were asked to reach a goal of two additional hours of physical activity per week, also indicated that more specific goals for implementation (i.e., when, where, how) were associated with significantly greater levels of physical activity at the end of the two week study period (de Vet et al., 2011). These findings are consistent with examinations

of qualitative reports of self-set goals in a sample of athletes (*n* = 249; ages 18–30 years), which revealed specific self-set goals enhanced reported outcomes in training and competition (Munroe-Chandler, Hall, & Weinberg, 2004).

Qualitative exploration of goal specificity for physical activity and healthy eating behaviours in overweight and obese adolescents (*n* = 18) has also shown goal attainment to be positively associated with a shift in setting vague weight-loss goals (i.e., "eat less" or "exercise") to specific goals (i.e., eating breakfast 3-days a week), rather than maintaining vague goals (e.g., giving up sugar "cold turkey") over a 1-year period following participation in a randomized controlled trial (Alm et al., 2008). Specific to healthy eating, experimental studies have shown that in comparison to vague goal conditions, assignment to specific goals for behaviour implementation (i.e., when and where) is associated with greater intake of fruit and vegetable intake in samples of adults and adolescents within a 2-week period following intervention (Armitage, 2007; de Nooijer, de Vet, Brug, & de Vries, 2006; Gratton, Povey, & Clark-Carter, 2007; Kellar & Abraham, 2005).

The current study addressed goal specificity by providing goal setting sheets that prompted recording of specific goal details in the short and long-term. For distal goals, specific details were recorded for the quantity of fruit, vegetable, and junk food serves (i.e., 2 serves), along with amount of physical activity (i.e., 20 minutes three times a week), step quantity (i.e., 8,000), and length of sedentary behaviour (i.e., 2 hours a day) to achieve in the long-term. Specific details were recorded each week for proximal goals that required the setting of goals for physical activity, sedentary behaviour, and healthy eating that clearly defined the quantity for each behaviour, which was aligned with the format defined for distal goals. Space was also provided to encourage recording of specific goals to reach each day for a nominated behaviour (i.e., eat one apple at lunch on Tuesday).

2.3.3.3 Goal proximity. A number of studies have provided support for the proposition in goal setting theory that setting both proximal and distal goals is associated with more positive health behaviour outcomes. For instance, Kyllo and Landers's (1995) meta-analysis conducted with regard to goal setting for sports and exercise, found the largest effect size for setting both proximal and distal goals (Hedges' g = .48), followed by proximal (.38), and distal (.19) goals. Similarly, Burton and Weiss (2008) found 8 of 13 studies supported jointly setting proximal and distal goals in their more recent meta-analysis of studies conducted in sport and physical activity domains.

In line with findings from the physical activity domain, Bandura and Simon (1977) demonstrated adults assigned to set distal (weekly) and proximal (associated with four daily food recording periods) goals achieved a significantly greater reduction in their quantity of food intake than adults assigned to focus only on distal goals over a 1-month period. Consistent with these findings, in a sample of university nutrition students, Schnoll and Zimmerman (2001) demonstrated that participants assigned to the combined proximal (25g to 35g of fibre a day) and distal (increase fibre intake 5g per week) goal condition reported significantly greater dietary fibre self-efficacy and fibre consumption than participants assigned to the no goal condition and control group. More recently, in an observational study, Nothwehr and Yang (2007) demonstrated at 1-year follow-up that setting more frequent goals to achieve long-term behaviour changes related to diet and physical activity, rather than goals focused on overall (e.g., distal) weight loss, were more strongly associated with implementation of behaviour strategies in an adult sample (*n* = 354).

Distal goals were defined in the current study as goals to reach by each data collection period (e.g., end of 8-week program, 3 months, 6 months, and 12 months), which were then divided into smaller more manageable weekly goals (e.g., proximal goals). Weekly

goals to achieve were then divided into daily goal behaviours related to physical activity, sedentary behaviour, and healthy eating. For instance, a distal goal to reach by the end of the intensive program could be to engage in physical activity for 30 minutes five times a week, and the weekly goal may reflect an increase in ten minutes of physical activity, and the daily goal may be to play soccer on Tuesday after school from 4.30 to 5.00 p.m. at the local park.

2.3.3.4 Goal feedback. Integral to the effectiveness of goal setting techniques (e.g., difficulty, specificity, proximity) is the provision of feedback. Feedback on performance occurs when individuals are aware of their progress results (Ashford & Cummings, 1983). When feedback is withheld, motivational mechanisms do not come in to play because individuals are not able to gauge if progress has been made, and subsequently can't determine if more effort or different strategies are required (Locke & Latham, 1990).

Among studies examining the effects of feedback on goal setting, the benefits associated with setting goals has been shown to be fully ineffective at increasing healthy lifestyle behaviours when feedback is withheld. For instance, Zizzi et al. (2006) provided no feedback to adolescents assigned to a goal setting only or no goal condition and found changes in their pedometer step counts were similar at conclusion of the 3-week intervention. Examining the benefits of feedback in conjunction with goal setting, Rodearmel et al. (2007) assigned overweight (including those at risk for overweight) adolescents and their parents to a condition encouraging goal setting alongside self-monitoring of pedometer steps or a condition using self-monitoring feedback of pedometer steps only. After the 6.5-month intervention period, adolescents and their parents in the intervention condition (e.g., goal setting and pedometer feedback) achieved significantly

greater number of daily steps from baseline in comparison to those in the control condition (e.g., pedometer feedback only).

Similar outcomes have also been demonstrated with regard to healthy eating behaviours. For instance, providing letters with tailored feedback on dietary intake and physical activity have been shown in adult samples to be associated with significant behavioural improvements at 12-week (Brug, Glanz, Van Assema, Kok, & van Breukelen, 1998) and 9-month (de Vries, Kremers, Smeets, Brug, & Eijmael, 2008) follow-up when compared to receipt of a general information letter. Similarly, providing feedback on goals for dietary intake and physical activity through a short message system (SMS) has been shown to predict reductions in BMI and waist circumference in adults (Donaldson, Fallows, & Morris, 2013), and increases in fruit and vegetable intake at 15-week follow-up in adolescents with low baseline intake (Bech-Larsen & Grønhøj, 2013).

Benefits of receiving feedback on set goals suggests behaviour change is likely to be promoted when interventions provide a framework for systematically reviewing goal progress (Greaves et al., 2011). Methods from goal setting theory therefore provide a highly structured means for receiving feedback in a format that has been demonstrated to successfully promote behaviour change. Optimising delivery of feedback is thus likely to enhance competence posited within self-determination theory. The provision of feedback using a goal setting structure was achieved in the current study by encouraging participants to set specific goal details (i.e., eat apple at lunch on Tuesday) that could be easily assessed for progress. Each week, time was also allocated for participants, alongside instructors, to record progress scores (e.g., 1 (*did not meet goal*) to 10 (*fully met goal*)) for set goals following a review of their weekly achievements. Pedometers were also provided and both

parents and adolescents were taught means for measuring serves of fruit, vegetable, and junk food intake.

2.3.3.5 Methods for delivery – collaborative goal setting. Participants' accurate uptake of goal setting processes is imperative for the success of goal setting as a motivational framework, and as such steps should be taken to ensure participants' proper execution of goal setting methods (Strecher et al., 1995). One means for ensuring benefits from goal setting are maximised is through the use of collaborative goal setting guided by instructor involvement. Collaborative goal setting entails jointly discussing goals to ensure they are appropriately matched in level of difficulty and clearly defined (Bodenheimer & Handley, 2009). Collaborative goal setting has been demonstrated within health care and sport settings to lead to greater goal attainment than self-set or assigned goals (Bodenheimer & Handley, 2009; Heisler, Bouknight, Hayward, Smith, & Kerr, 2002; Kyllo & Landers, 1995).

Providing specific goal suggestions for behaviour has also been shown in adolescent samples to increase physical activity and healthy eating behaviours (Contento, Koch, Lee, & Calabrese-Barton, 2010; Shilts, Horowitz, & Townsend, 2009). Goal options, or guided goal setting, allows participants to choose from a range of practitioner derived goals (Shilts et al., 2004). Selecting goals in collaboration with instructor support is likely to overcome the possibility of participants adopting inappropriate goals, and instead ensure set goals include components necessary to maximize goal attainment (Shilts et al., 2013). This style of goal setting has also been shown to be particularly salient for adolescents (Contento et al., 2010; Vierling, Standage, & Treasure, 2007) who are moving from the developmental stage of understanding concrete concepts to more abstract concepts (Carraça et al., 2011) required for goal setting (Standage et al., 2012).

Given the benefits of collaborative goal setting with instructor support, instructors in the current study trained adolescents and parents in using goal setting techniques (e.g., difficulty, specificity, proximity) and then lead participants each week in goal setting processes. For instance, based on examples provided of weekly goals, adolescents were asked to use the highly structured goal setting pages to record their weekly goal for healthy eating and the instructor followed by speaking to each adolescent to ensure their set goal was comprised of the necessary goal setting properties. When goals were reviewed the instructor drew adolescents' attention to their weekly goal for healthy eating and prompted them work through steps for reviewing progress and setting goals for the following week. Instructors reminded adolescents to adjust their goals according to goal difficulty assigned and to ensure their proximal goals were specific through individual follow-up discussions. Collaborative goal setting was further extended to the home environment by fostering conversations within families to ensure adolescent goals were reasonable within the context of available resources provided by parents. Setting guided goals in a collaborative manner was posited to optimise goal attainment by providing an effective means for delivering a need-supportive goal environment. This was achieved through collaborative involvement from instructors and parents as well as the promotion of goal choice.

2.3.4 Implementing goal setting theory to promote health behaviour. Despite substantial evidence (i.e., Locke et al., 1981; R. E. Wood, Mento, & Locke, 1987) in workplace settings demonstrating the benefits of addressing goal difficulty, specificity, and proximity to enact motivational mechanisms (e.g., effort, persistence, and directionality) posited in goal setting theory to foster behaviour change (Locke & Latham, 1990), limitations exist in the delivery of goal setting techniques implemented in interventions aimed at modifying healthy lifestyle behaviours. In a review of the effectiveness of goal

setting as a behaviour change strategy for dietary change, K. W. Cullen, Baranowski, and Smith (2001) identified a substantial number of studies purporting to use goal setting with children and adolescents. However, only three studies provided details about goal-setting components and none analysed outcomes in relation to goal-setting processes (K. W. Cullen et al., 2001). Although significant increases were demonstrated for intake of healthier food items within the three identified studies, none systematically varied components of the intervention to include or exclude goal setting. Procedures promoting goal setting in children and adolescents thus could not be solely attributed to explain changes in healthy eating behaviours (K. W. Cullen et al., 2001).

The authors also (K. W. Cullen et al., 2001) reviewed the use of goal setting in adult samples, and found only one study (e.g., Berry, Danish, Rinke, & Smiciklas-Wright, 1989) included goal properties responsible for activating the necessary motivational mechanisms outlined in goal setting theory. Participants were assigned to three groups (e.g., goal setting plus healthy lifestyle intervention, goal setting only, or control), although the degree of exposure to goal setting was coupled with exposure to additional intervention components over 12 (goal setting plus healthy lifestyle) versus 2 (goal setting only) sessions, thus making it difficult to draw conclusions in respect to the effectiveness of goal setting methods (K. W. Cullen et al., 2001).

In a review of diet and physical activity behaviour change interventions featuring goal setting, Shilts, Horowitz, and Townsend (2004) rated interventions according to the level of goal setting support demonstrated. Minimal support was defined as including a set goal but providing no additional support. Moderate support included components based on goal setting theory but not supporting the full range of goal setting aspects. Full support was defined as providing extensive goal setting support in line with postulates of goal setting

theory (e.g., specificity, difficulty, and proximity). Of the 28 studies meeting inclusion criteria, only nine (e.g., 32%) provided full support. Further, of the nine studies, only one intervention targeted children, and none fully supported adolescent goal setting for physical activity or dietary behaviour changes. Shilts et al. (2004) concluded that interventions fully supporting goal setting were more likely to promote behaviour maintenance, indicating that adolescents are likely to benefit from interventions fully supporting goal setting methods, although further research was called for to confirm this hypothesis.

In order to determine the effectiveness of theoretically derived self-regulation techniques, Michie, Abraham, Whittington, McAteer, and Gupta (2009) more recently applied a taxonomy of behaviour change techniques to a systemic review of interventions to increase levels of physical activity or healthy eating in adults. Behaviours consistent with goal setting theory included setting graded tasks, prompting specific goal setting, prompting review of behavioural goals, and providing feedback on performance. According to the assigned taxonomy, from the 101 studies meeting inclusion criteria (55 physical activity, 35 healthy eating, and 18 both), only one study included the full range of possible behaviour techniques consistent within goal setting theory (Michie et al., 2009).

Bodenheimer and Handley (2009) further reviewed available literature to assess the effectiveness of goal setting in primary care settings in samples of adolescents and adults. Only three studies were identified that offered full support for goal setting, and these were limited to samples of adults (Glasgow, Toobert, & Hampson, 1996; Goldberg, Lessler, Mertens, Eytan, & Cheadle, 2004; Handley et al., 2006). However, in one study only a quarter of participants implemented goals following assignment in the primary care setting (Handley et al., 2006), and in a second study behaviour outcomes were not assessed (Goldberg et al., 2004). In the third study, participants assigned to the goal setting plus

follow-up support condition demonstrated significant differences at 3-month follow-up for calorie intake in comparison to those assigned to usual care (e.g., provided feedback on their current health status) (Glasgow et al., 1996), although follow-up intervention included materials addressing overcoming barriers and may have confounded effects of goal setting.

E. S. Pearson (2012) systematically explored the use of goal setting as a behaviour change strategy to promote diet and physical activity behaviours in overweight and obese adults targeted in community-based interventions. Although the review focused on evaluating the specific components of goal setting that were responsible for behaviour change, the inclusion criteria was loosely based on principles of goal setting theory (Locke & Latham, 1990). More specifically, literature was assessed according to the following techniques employed to deliver goal setting: specificity, timing, acquisition, rewards, and tools. E. S. Pearson (2012) concluded that interventions focusing on goal setting can be effective at changing diet and physical activity related behaviour among overweight and obese adults participating in community-based programs. While these findings are useful in demonstrating support for key elements of goal setting theory, a notable limitation is the lack of exploration regarding an integral component of goal setting theory (Locke & Latham, 1990), which is goal difficulty. Failure to include the full range of goal setting support detailed within Locke and Latham's (1990) goal setting theory further demonstrates the lack of consistency in the literature with regard to implementing goal setting strategies to promote physical activity and healthy eating behaviour changes.

The current study sought to address previous limitations by providing a comprehensive goal setting structure based on goal properties in line with goal setting theory (Locke & Latham, 1990) to promote adolescent behaviour changes and parents' resource distribution to support adolescents' changes. Adolescents and parents were

provided with descriptions of each goal property (e.g., difficulty, specificity, and proximity) alongside meaningful rationale for their application. Participants were also guided through goal setting sheets, which required the setting of specific, difficult, and proximal and distal goals in ways responsible for eliciting motivational mechanisms necessary for behaviour change. Further consideration of how goal setting techniques were applied within the family context is reviewed in the following section (2.3.5). Limitations of current evidence-base within family settings are discussed and study objectives presented in line with identified shortcomings.

2.3.5 Implementing goal setting theory within the family context. Parents are proposed to play an integral role in adolescents' ability to attain goals for behaviour change due to parents' role in delivery of available resources (Latif et al., 2011). Resource availability refers to an individual's access to resources and is proposed to be necessary for goal attainment (Locke & Latham, 2013). Although numerous studies have reported the importance of resources provided by parents with regard to influencing adolescents' behaviour uptake (Hanson et al., 2005; Utter, Scragg, Schaaf, & Ni Mhurchu, 2010), parents' perceptions of their role in adolescents' goal striving processes are often reported to be muddled and not clearly delineated. Results of focus groups conducted with parents of obese adolescents have reported parents believe their role is to provide support by means of controlling strategies (i.e., pressuring to control intake) rather than acknowledging a supportive role via the provision of healthy food environments and engagement in physical activity (Lindelof, Nielsen, & Pedersen, 2010; Shrewsbury et al., 2010; Twiddy et al., 2012).

Providing a structure that clearly details parents' role in resource distribution is thus likely to benefit both adolescents and parents by aligning parent behaviours with resources necessary for adolescent goal attainment (Twiddy et al., 2012). Similar to adolescents,

parents are also likely to benefit from the implementation of goal setting methods to promote their own behaviour engagement in resource distribution (K. W. Cullen et al., 2010). However, investigations of the relationship between parent goal attainment for resource distribution and adolescents' subsequent goal attainment and behaviour engagement is currently lacking. Despite the need to understand effective processes for delivering goal setting methods within family contexts, current reviews of the effectiveness of goal setting in healthy behaviour change (see section 2.3.4) have not focused specifically on processes underlying goal setting within a family context.

The only study to date to explore parent goal attainment for resource distribution examined outcomes in a sample of 372 low-income parents (children aged 18 years and under) following attendance at six parent-only program sessions (K. W. Cullen et al., 2010). Findings indicated a higher level of parent goal attainment was significantly associated with improvements in food preparation practices including: modifying meat to reduce fat, providing reduced fat options, improving availability of fruit and vegetables, and reducing provision of sugary foods (K. W. Cullen et al., 2010). Greater parent goal attainment was also significantly related to self-report availability of vegetables, planning/encouraging fruit and vegetable consumption, and menu planning skills. Further, parent goal attainment was associated with regular parental intake of fibre, vegetables, and water (K. W. Cullen et al., 2010). While findings from the study were instrumental in highlighting the importance of engaging parents in goal setting processes to deliver resources necessary for adolescents' engagement in healthy lifestyle behaviours, children and adolescents' associated goal attainment and behaviour engagement were not reported in relation to parent goal attainment.

Other approaches to examining parents' role in children and adolescents' goal setting processes have typically cast goals for the family to achieve as a whole, with limited description of how family members' behaviours relate to the collective goal. Descriptions of the family goal setting processes in these instances are often rather vague referring only to the fact that a "family goal" was set (i.e., Boutelle, Cafri, & Crow, 2011; LaRowe, Wubben, Cronin, Vannatter, & Adams, 2007; Salminen, Vahlberg, Ojanlatva, & Kivelä, 2005; Wolcott, Huberty, McIlvain, Rosenkranz, & Stacy, 2011). Studies reporting more discriminate details aligned with aspects of goal setting theory have included the assignment of goals in the following ways: parent goal supported (i.e., provide environment free of junk food) child/adolescent goal (i.e., reduce junk food intake) (Hammer, 2003); child/adolescent and parent independently strove for goals related to his/her respective physical activity and healthy eating behaviour levels (Epstein, Paluch, Beecher, & Roemmich, 2008); or identical goals (e.g., 60 minutes a day of physical activity) for both the parent and child/adolescent to pursue (Quattrin et al., 2012). However, the parent support goal only explored changes in relation to a single behaviour (e.g., junk food) associated with restriction (Hammer, 2003), rather than the provision of multiple resources (e.g., fruit, joint physical activity). In addition, independent goal strivings (Epstein et al., 2008; Quattrin et al., 2012) focused on weight as a goal and did not take into account parents' role in distributing resources to map on to children's/adolescents' behaviour goals (Quattrin et al., 2012).

The generalizability of findings associated with studies investigating more direct mapping of multiple parent goals have also been limited by procedural shortcomings. For instance, out of parents (n = 19) assigned to use a website program weekly (8 sessions) to set goals to support their daughters' (M age = 8) physical and healthy eating behaviours, less than half logged on to use the website and parents' engagement in goal setting behaviours

were not reported (Baranowski et al., 2003). During a 14-week intervention, Burten et al. (2011) trained parents (*n* = 29 families) and their children (9 to 12 years of age) in goal setting methods and required each to record their role in achieving the goal (i.e., parent to walk with child 20 minutes after school each day). Although results at 1-year follow-up showed improvements in parents' shopping, cooking, and physical activity behaviours and children's physical activity (i.e., walking), the relationship between these behaviours and goal attainment were not reported, and thus could have been attributed to additional intervention effects. In addition, other approaches have encouraged separate goal setting that promoted parent modelling within the intervention. However, implemented goal setting properties (e.g., specific, difficult, proximal) were not reported, and method details for how parent goals may have mapped on to children's/adolescents' behaviour goals were neglected (e.g., Bean, Mazzeo, Stern, Bowen, & Ingersoll, 2011; Janicke et al., 2011; Janicke et al., 2008; O'Connor, Hilmers, Watson, Baranowski, & Giardino, 2011; Shrewsbury et al., 2009).

The current study sought to address previous methodological issues by providing an intervention structure that engaged both parents and adolescents in methods aligned with goal setting theory while also promoting a dialogue between adolescents and parents with regard to situational resources parents can make available, through their own goal attainment, to assist adolescents in achieving their goals (Boiché & Sarrazin, 2009). By making parents more aware of adolescents' goals for their health behaviour, more adaptive adolescent behaviour outcomes were proposed to ensue (Butler et al., 2011; Lundell, Grusec, McShane, & Davidov, 2008).

Parent goals were aligned with adolescent goals within the current study by asking adolescents to set distal goals with the understanding that each week they would review

goal progress and set new proximal goals to help work toward their distal goal. Parents were then asked to work toward supporting distal goals listed by adolescents and to set proximal goals in line with goal behaviours adolescents listed. Parent behaviour goals thus reflected the resources adolescents needed to achieve their behaviour goals. For instance, an adolescent with a goal to eat one piece of fruit for lunch during schooldays was aligned with a parent goal to pack one piece of fruit in the adolescent's school lunch. Parent and adolescent goal attainment was therefore proposed in the current study to predict adolescent behaviour change outcomes for physical activity and healthy eating.

2.3.6 Summary (goal setting theory). In accordance with goal setting theory, setting goals that addressed difficulty, specificity, and proximity were proposed to promote behaviour maintenance by activating motivational mechanisms (e.g., effort, persistence, and direction) required for behaviour change (Locke & Latham, 2013). Despite evidence demonstrating the effectiveness of individual components of goal setting (e.g., difficulty, specificity, and proximity), there remains a relative dearth of studies investigating the delivery of all goal setting components in a healthy lifestyle behaviour intervention to improve adolescent behaviour outcomes. In addition, only a limited number of studies have addressed longitudinal benefits associated with goal attainment following intervention (Michie et al., 2009). Among the studies that have examined the long-term effectiveness of behavioural interventions promoting methods based on goal setting theory, findings have more frequently been reported in relation to adult samples (Hall, Crowley, Bosworth, Howard, & Morey, 2010), with limited exploration with regard to adolescent outcomes (Shilts et al., 2004). Previous studies have also been limited in exploration of outcomes associated with parents' engagement in goal setting methods to assist in motivating distribution of resources to support adolescent goal attainment.

Given goal setting functions as a strategy for motivating behaviour change while also providing a structure for implementing these changes, exploring the long-term effectiveness of a goal setting structure aimed at adolescent and parent behaviours is necessary. Methods from goal setting theory were adopted in the current study by asking adolescents and parents to set goals for their behaviour changes using the previously reviewed techniques inclusive of goal difficulty, specificity, and proximity. Adolescents were encouraged to set goals in the areas of physical activity (e.g., moderate-to-vigorous and step count), sedentary behaviour, and healthy eating (e.g., fruits, vegetables, and junk food). Parent goals reflected behaviour changes with regard to their provision of resources to support adolescents' access to goals set for healthy lifestyle behaviour changes (i.e., purchasing fruit to assist with an adolescent's goal to eat one fruit serve/day). Collaboratively engaging both adolescents and parents in the goal setting process also provided both a means for instructors to ensure goals were set appropriately and a check system for parents and adolescents to discuss the feasibility and implementation of goals in the home environment.

2.4 Integrating Self-Determination Theory and Goal Setting Theory

2.4.1 Introduction. Despite the success of motivational mechanisms underpinning goal striving processes (Shilts et al., 2013), shortcomings still remain within techniques outlined in Locke and Latham's (1990) goal setting theory. Within the theory, goal success is posited to result from people's belief that goal attainment leads to value attainment, with no consideration given to the variability among reasons underlying goal strivings. In line with these propositions, meta-analyses have demonstrated that goal commitment, or one's expectancy of goal attainment, moderates the relationship between difficult goals and performance (Donovan & Radosevich, 1998; Klein et al., 1999). However, the authors concluded that alternative explanations should be proposed given that instances have been

observed when individuals with low expectancy are committed to their goals, or when individuals with high expectancy are not committed to their goals. Sheldon and colleagues (Sheldon & Elliot, 1999; Sheldon & Kasser, 1998) offered an alternative means for understanding the relationship between goal commitment and goal attainment by showing individuals' degree of internalization predicted attainment above and beyond commitment, which suggests that variations in goal attainment reflects individuals' need satisfaction (Sheldon, Turban, Brown, Barrick, & Judge, 2003). Self-determination theory provides an explanation for such variations by considering goals as containing either *intrinsic* or *extrinsic* content, with reasons for striving toward such goals defined in terms of motivations, or their degree of autonomy (Deci & Ryan, 2000). The contribution of considering goal contents and motives for goal strivings are reviewed in turn below.

2.4.2 Goal contents: Intrinsic and extrinsic.

2.4.2.1 Introduction. Failure within goal setting theory (Locke & Latham, 1990) to consider the kinds of goals people set for their behaviour engagement is of great concern given the variability represented within the content of individuals' goals. For example, some people might exercise to improve their physical health whereas others may be focused on the benefit of appearing attractive to others. In both instances, each goal type appears on the surface to support the same end activity (e.g., exercise). However, the associated outcomes on the path to goal attainment may vary substantially as a reflection of the divergent goal types endorsed by each individual (Niemiec, Ryan, & Deci, 2009). In contrast to the lack of distinction regarded in goal setting theory (Locke & Latham, 1990), these variations are delineated in self-determination theory as containing either *intrinsic* or *extrinsic* goal content (Deci & Ryan, 2000).

Intrinsic goals such as health, self-acceptance, and affiliation (Kasser, 2002b), are postulated to promote people's natural growth processes to develop satisfying relationships with others, to gain personal competence, and to feel a sense of achievement in personal gains (Kasser & Ryan, 1996). As such, people's time and energy is focused less on ego-involved behaviours and more on self-actualising behaviours (Kasser & Ryan, 1996), which are inherently gratifying and likely to promote the satisfaction of basic needs for autonomy, competence, and relatedness (Deci & Ryan, 2000; Kasser, 2002b; Sebire et al., 2009; Sheldon, Elliot, Kim, & Kasser, 2001).

In contrast, extrinsic goals such as wealth, social acceptance, and appearance are contingent on acquiring external indicators of self-worth, which undermines autonomous motivation (Ryan & Deci, 2004; Vansteenkiste, Neyrinck, et al., 2007). Adoption of extrinsic goals is proposed to detract individuals from satisfying their innate growth tendencies by orienting them to focus their energy and resources on social comparisons (Patrick, Neighbors, & Knee, 2004) and gaining satisfaction from sources external to the self (Kasser, Ryan, Couchman, & Sheldon, 2004), rather than realising self-actualizing behaviours (Kasser, 2002a). These micro-motivational processes, described as enacting an *attentional shift, interpersonal comparisons*, and *rigid approaches* to performance methods, thus interact to thwart basic needs for autonomy, competence, and relatedness (Vansteenkiste, Soenens, & Lens, 2007). For example, setting an extrinsic goal shifts an individual's attention away from the activity and toward external indicators of worth, which creates social comparisons, leading to thwarted need satisfaction and feelings of insecurity, which, in turn, brings an individual's attention back to the activity, although the attention given evokes a rigid approach because the activity is undertaken to supress feelings of insecurity arising from needs thwarting (Vansteenkiste, Soenens, et al., 2007). Consequently, such behaviours

associated with extrinsic goals often lead individuals to act in ways to thwart their basic needs (Kasser, 2002a).

Due to the associated experiences of needs-thwarting encountered during extrinsic goal pursuits, maladaptive outcomes are posited within self-determination theory to persist even when individuals attain set goals (Deci & Ryan, 2000). Conversely, attainment of intrinsic goals is proposed to lead to continued behaviour engagement due to the satisfaction of psychological needs (Deci & Ryan, 2000). This distinction is particularly salient as it stands in contrast to mechanisms forwarded within goal setting theory (Locke & Latham, 1990), which suggest that goal attainment alone will promote behaviour maintenance. The need to consider goal contents within the structured goal setting techniques proposed in Locke and Latham's (1990) goal setting theory is argued below within the context of studies demonstrating positive outcomes associated with intrinsic goal pursuits and the detrimental effects of extrinsic goal pursuits.

2.4.2.2 Goal contents and the related outcomes. Outcomes associated with setting goals laden with content that either supports or thwarts need satisfaction have been explored across a range of domains. Initial investigations assessed the cross-sectional relationship between goal contents comprised in set goals and levels of well-being in adults, with particular attention afforded to the intrinsic aspirations of self-acceptance, affiliation, community feeling (Kasser & Ryan, 1993, 1996), and physical health (Kasser & Ryan, 1996), and the extrinsic aspirations of financial success (Kasser & Ryan, 1993, 1996), fame (social recognition) and appearance (Kasser & Ryan, 1996). Intrinsic goal aspirations were shown to be positively related to self-actualisation, vitality, global functioning, and social productivity, and negatively related to depression, anxiety, behaviour problems, and physical symptoms (Kasser & Ryan, 1993, 1996). In contrast, placing greater importance on extrinsic goals was

shown to be negatively associated with self-actualisation, vitality, global functioning, social productivity, well-being, and positively associated with depression, anxiety, behaviour problems, symptoms of distress, and daily affect (Kasser & Ryan, 1993, 1996).

Extending explorations to outcomes associated with goal attainment as a function of goal contents related to personal projects in a sample of university students (*n* = 90), Sheldon and Kasser (1998) found intrinsic goal orientations modified the effects of goal progress scores on measures of well-being (e.g., life satisfaction, negative/positive affect, and depression) in the short-term (e.g., 5-day period) and long-term (e.g., semester). Students with intrinsic goals reached higher levels of well-being when goals were attained and lower levels of well-being when limited goal progress was made. In contrast, well-being levels for students with extrinsic goals remained unchanged regardless of goal progress achieved (Sheldon & Kasser, 1998). Kasser and Ryan (2001) further demonstrated that university students classified as attaining goals with high intrinsic, low extrinsic content had significantly higher levels of well-being and self-esteem, and higher quality of relationships with friends and romantic partners than students with goal attainment marked by low intrinsic, high extrinsic content.

The relationship between goal contents and affective outcomes was further supported in a longitudinal study exploring college seniors' (*n* = 147) goal attainment at one year post-graduation (Niemiec et al., 2009). Results indicated that goal type (intrinsic or extrinsic) reported shortly before graduation was associated with the type of goal attained at 1-year follow-up (Niemiec et al., 2009). Further, attaining intrinsic goals at 1-year post-graduation positively predicted psychological well-being and negatively predicted ill-being, whereas attainment of extrinsic goals was positively related to ill-being and unrelated to psychological well-being. Changes in intrinsic goal attainment over the 1-year period were

also positively associated with change in well-being; whereas, changes in ill-being over this period were positively related to change in extrinsic goal attainment (Niemiec et al., 2009). In addition, the association between change in well-being and intrinsic goal attainment was shown to be mediated by changes in satisfaction of basic needs for autonomy, competence, and relatedness (Niemiec et al., 2009).

Exploring outcomes associated with goal content in the health behaviour context, Piko (2006) demonstrated in a sample of secondary school students (*n* = 1109; *M* age = 16.5) that adolescents classified as regularly active (e.g., reported engaging in extra sport a minimum of once a week), compared to those classified as less active (e.g., reported engaging in no or occasional sports activity in the past three months), endorsed significantly less extrinsic life values for financial success, attractive appearance, and social recognition. Thøgersen-Ntoumani, Ntoumanis, and Nikitaras (2010) further demonstrated need satisfaction and reported unhealthy weight control behaviours were positively predicted by intrinsic aspirations (e.g., health goals) and negatively predicted by extrinsic aspirations in a cross-sectional sample of adolescents (*n* = 350; *M* age = 13.58). Examination of university students (*n* = 118; *M* age = 20.8) involved in recreational and competitive sport contexts also demonstrated that athletes' attainment of intrinsic goals enhanced well-being, whereas extrinsic goal attainment failed to predict enjoyment and optimal states of wellness (Chatzisarantis & Hagger, 2007).

Qualitative findings have further demonstrated that adult fitness club members who endorsed intrinsic exercise goals were more confident in their ability to attain goals, less likely to use social comparisons, more likely to view goal achievement as a long-term process, assess goal progress using process-based criteria (i.e., effort and bodily sensations), and to use a flexible approach to goal progress (Sebire, Standage, Gillison, & Vansteenkiste,

2013). Instances of intrinsic goal achievement were also perceived as providing lasting positive effects whereas unmet intrinsic goals were accepted or interpreted as requiring further persistence or requiring an adaption to exercise routines. In contrast, extrinsic goal setters exhibited more social comparisons and subsequent feelings of deflation, jealousy, and self-doubt (Sebire, Standage, et al., 2013). Extrinsic exercise goal pursuits were further characterised by desires for a quick-fix/immediate result, low confidence, rigid approaches to goal progress, external indicators of progress (i.e., outcomes based on the reaction of others), pressure to maintain goal progress, and greater rates of drop-out when goals were not achieved (Sebire, Standage, et al., 2013).

Collectively, these findings indicate that individuals are more likely to experience optimal outcomes when set goals reflect intrinsic content rather than extrinsic content. However, despite the array of maladaptive outcomes associated with extrinsic goals, the aforementioned studies demonstrate that the endorsement of extrinsic goals still persists. This contradictory phenomenon is posited to occur because extrinsically-oriented individuals are ultimately trying to obtain the same outcomes as intrinsically-oriented individuals, but are unaware of the inhibitory nature of extrinsic goals (Sheldon, Gunz, Nichols, & Ferguson, 2010). Specifically, Sheldon et al. (2010) demonstrated that extrinsically-oriented individuals are more likely to report believing they will feel autonomous and competent by attaining extrinsic goals, while holding less of a belief that they will feel related to others as a result of obtaining extrinsic goals. Therefore, extrinsic goal-oriented individuals are motivated to attain goals under the false pretence that extrinsic goal attainment is necessary for satisfying basic needs for autonomy and competence (Sheldon et al., 2010).

Findings from experimental research have however demonstrated that individuals are capable of distinguishing between intrinsic and extrinsic goal contents (McLachlan & Hagger, 2010a, 2011). Interventions seeking to enhance behaviour engagement through goal striving processes must therefore consider methods for orienting individuals to seek intrinsic, rather than extrinsic goals (Vansteenkiste, Matos, et al., 2007). Given the importance of fostering intrinsic goal pursuits, the following section provides a review of evidence-based approaches aimed at modifying individuals' pursuit of intrinsic goals. Findings are then discussed in the context of the current study, which sought to encourage adolescents and their parents to set goals with intrinsic content within the goal setting structure proposed by Locke and Latham (1990).

2.4.2.3 Goal content framing. Manipulations of goal contents were first carried out in a series of studies conducted by Vansteenkiste and colleagues (Vansteenkiste, Simons, Braet, Bachman, & Deci, 2007; Vansteenkiste, Simons, Lens, Sheldon, et al., 2004; Vansteenkiste, Simons, Lens, Soenens, et al., 2004; Vansteenkiste, Timmermans, Lens, Soenens, & Van den Broeck, 2008), which presented participants with written instructions promoting either intrinsic (i.e., "Doing a little Tae Bo helps you to remain physically fit and prevents you from becoming sick at a later age.") or extrinsic (i.e., "Doing a little Tae Bo helps you to remain physically appealing to others and prevents you from gaining weight at a later age.") goals with either autonomous (i.e., "you can" and "you might") or controlling (i.e., "you should" and "you have to") language prior to engaging in a novel activity. In the first series of studies, Vansteenkiste, Simons, Lens, Sheldon, and Deci (2004) manipulated instruction for learning tasks related to recycling (Study 1; trainee preschool teachers), workplace communication styles (Study 2; university marketing students), and Tae-bo exercises (Study 3; high school students) and consistently demonstrated that intrinsic goal

framing enhanced processing depth, test performance, and learning persistence (i.e., pursuit of free choice behaviours related to learning activity ranging from 2 to 9 days post-manipulation) regardless of the type of activity sought in the behaviour change process (Vansteenkiste, Simons, Lens, Sheldon, et al., 2004). Including the environmental climate (i.e., autonomous or controlled) also yielded similar findings, showing positive main effects for autonomous motivation and intrinsic goal content on performance outcomes (Vansteenkiste, Simons, Lens, Sheldon, et al., 2004).

Building on these findings in a sample of high school students (*n* = 501) exposed to instruction on Tae-bo, Vansteenkiste, Simons, Soenens, and Lens (2004) demonstrated that intrinsic goal framing was positively associated with autonomous motivation, performance, and persistence at 1-month and 4-month follow-up in contrast to no-goal framing. Extrinsic goal framing, in contrast to no-goal framing, was associated with controlled motivation and lower levels of performance and persistence at 1-month and 4-month follow-up. In addition, no differences were shown between the no-goal and content-free conditions (Vansteenkiste, Simons, Soenens, et al., 2004). Consistent with recent cross-cultural findings (Z. Wang, Hu, & Guo, 2013), the effects of intrinsic goals were further shown to be most effective when participants were exposed to autonomy supportive classroom instruction in comparison to controlling instruction (Vansteenkiste, Simons, Soenens, et al., 2004).

Outcomes associated with goal content framing in the context of healthy eating was examined in a sample of overweight and obese early adolescents (*n* = 87 students from 29 classes; 11 to 12 years of age) exposed to either an intrinsic (i.e., “Children who eat a piece of fruit each day are much more likely to remain physically fit than early adolescents who eat candy.”) or extrinsic (i.e., “Children who eat a piece of fruit each day are much more likely to remain good-looking and attractive to others than early adolescents who eat

candy.") goal framing condition prior to reading a nutrition text about a "four leafed clover" (Vansteenkiste, Simons, et al., 2007). Consistent with the postulates of self-determination theory (Deci & Ryan, 2000), in the short-term, intrinsic and extrinsic goals predicted higher levels of healthy eating (e.g., reduced candy and soft drink consumption and increased fruit intake) and weight loss (one and four weeks post-intervention), but changes were only maintained at 2-year follow-up by participants in the intrinsic goal condition. Both conditions were also positively associated with initial attendance in voluntary diet (10-week) and exercise (6-week) programs offered to participants following reading instruction, but attendance rates declined in the long-term for participants in the extrinsic goal condition (Vansteenkiste, Simons, et al., 2007).

Evidence demonstrated in support of the benefits associated with intrinsic goal contents (i.e., Vansteenkiste, Simons, Lens, Soenens, et al., 2004; Vansteenkiste, Simons, Soenens, et al., 2004) is in line with the tenets of self-determination theory, which suggest that adaptive outcomes are associated with the pursuit of intrinsic goal contents regardless of one's predisposition (Deci & Ryan, 2000). In contrast however, research favouring the match-perspective (Pervin, 1968; Schneider, 1987) suggests an interaction between personal and situational goal pursuits, such that intrinsic, compared to extrinsic, goal framing environments would only influence individuals with an intrinsic pre-task goal orientation. Using a sample of 5^{th} and 6^{th} grade students (n = 138), Vansteenkiste, Timmermans, Lens, Soenens, and Van den Broeck (2008) tested the two hypotheses and found main effects from goal content framing were not moderated by students' goal-orientation, but instead, the effects of intrinsic goal framing on autonomous motivation, conceptual learning, and rote learning remained present regardless of students' goal-orientation prior to task engagement. These findings indicate that framing a task in terms of

intrinsic goal attainment results in more optimal outcomes irrespective of individuals' intrinsic or extrinsic goal-orientation prior to task engagement (Vansteenkiste et al., 2008). Interventions that seek to create intrinsic goal framing conditions are therefore likely to promote positive behaviour outcomes, regardless of one's pre-existing goal orientation (Vansteenkiste, Duriez, Simons, & Soenens, 2006).

Evidence from the series of studies conducted by Vansteenkiste and colleagues (e.g., Vansteenkiste, Simons, et al., 2007; Vansteenkiste, Simons, Lens, Sheldon, et al., 2004) suggest that even brief intervention is sufficient to foster changes in motivation and behaviour persistence. However, evidence was limited to the exploration of individuals' adoption of novel behaviours, with no consideration of how goal content framing may influence existing behaviours. Gillison, Standage, and Skevington (2013) addressed these limitations in a study exploring student (n = 592; M age = 13.74) outcomes following allocation to a control group, or an intrinsic (i.e., emphasised goal of staying physically fit and healthy) or extrinsic (i.e., emphasised goal of appearance and weight loss) goal framing condition delivered by a research team member in either an autonomy-supportive (i.e., "we are asking", "you can choose") or controlling (i.e., "you should", "you have to") context (e.g., five groups) during a single physical education class that led students through applying existing behaviours during circuit training. Intervention effects were measured immediately following receipt of the manipulation framing script and completion of the 10-minute circuit training activity. Across all conditions, no significant changes were demonstrated with regard to motivation, effort, enjoyment, and affect. However, manipulation checks demonstrated that students' perception of extrinsic goal framing was successfully influenced by the brief introductory script, whereas perceptions of intrinsic goal content

were not elicited. Findings therefore could only be conceptualized with regard to extrinsic goal framing.

Outcomes with regard to goal content framing for existing behaviours suggest that in comparison to novel tasks, repeated exposure to intrinsic goal framing may be necessary to influence outcomes related to engagement in existing behaviours (Gillison et al., 2013). In addition, literature from goal setting theory suggests behaviour maintenance for existing tasks is achieved through individuals' continued use of goal setting strategies, rather than exposure to a single set goal (e.g., Bandura, 1977; Nothwehr & Yang, 2007). However, to date there has been no investigation of repeated exposure to goal content framing in relation to existing behaviour.

Previous studies exploring manipulations of goal contents have also been restricted to the assignment, rather than the self-generation and/or collaborative setting of intrinsic goal content. Given the widespread use of self-generated/collaboratively set goals as a health behaviour change strategy (Shilts et al., 2013), it is therefore imperative to examine whether individuals can be encouraged to set multiple intrinsic goals for their own behaviour changes, yet this has not been addressed in the self-determination theory literature (Lens, Paixão, Herrera, & Grobler, 2012).

Studies examining outcomes associated with goal imagery suggest individuals are likely to benefit from environments that promote actively reflecting on setting goals laden with intrinsic content (Hausenblas, Hall, Rodgers, & Munroe, 1999; Rodgers, Hall, Craig, & Munroe, 2001). More specifically, imagining goals related to appearing healthy (e.g., "I imagine a "fitter me" when exercising), has been shown in adolescents and adults to predict increased levels of engagement in physical activity (Cumming, 2008; Gammage, Hall, & Rodgers, 2000). Imagery related to exercise technique and enjoyment has also been shown

in a sample of adult exercisers (*n* = 318; *M* age = 40.29) to predict more autonomous motivation, which in turn, predicted greater levels of self-reported exercise (Stanley, Cumming, Standage, & Duda, 2012). In contrast, appearance-based imagery was shown to directly predict greater levels of controlled motivation and intention to exercise, which suggests appearance-based imagery may instil motivation, but the quality of motivation is likely to be controlled (Stanley et al., 2012). Providing rationale for intrinsic goal setting (i.e., health) and asking participants to actively reflect on setting goals for intrinsic reasons is thus likely to foster behaviour changes and persistence in these behaviours (Giacobbi, Hausenblas, Fallon, & Hall, 2003).

The current study sought to address previous limitations by exploring whether instructors could be trained to promote repeated setting of intrinsic goals for existing behaviours in the context of goal setting properties proposed in goal setting theory (e.g., difficulty, specificity, proximity). Previous studies examining goal content framing have also been implemented in intervention settings by research team members; this is neither practical nor feasible in 'real life' situations and there is a need to provide more 'ecologically valid' interventions that involve practitioners in intervention delivery. To date, no instructors external to the research team have been trained to deliver methods for promoting intrinsic goal setting. Training instructors was achieved in the current intervention by providing instructors with rationale for setting intrinsic, rather than extrinsic goals, and asking instructors to take participants through structured goal setting sheets that required participants to reflect on what (e.g., goal content) they wanted to achieve for their set goals. Examples of intrinsic goal contents were provided for each behaviour goal (e.g., physical activity, healthy eating, and sedentary behaviour) as a guideline for promoting the setting of intrinsic goals. For instance, an intrinsic goal for adolescents was "to be physically

active", and for parents the goal of "my adolescent being physically active". In line with instructor training, participants learned rationale for reflecting on goal contents, and received examples and structured means for including intrinsic goals in their set behaviour goals (see sections 3.7.2 and 3.7.3).

2.4.3 Motives for goal strivings: Autonomous and controlled.

2.4.3.1 Introduction. In addition to considering goal contents, Deci and Ryan (2000) propose that individuals' motivations for goal strivings should be considered in predicting behaviour outcomes. Within self-determination theory, goal contents and motives for goal strivings are hypothesised to be associated processes, although each is proposed to make a distinct contribution to the prediction of behaviour outcomes (Deci & Ryan, 2000). Motives for goal strivings are conceptually different to goal contents and explain whether goal strivings are performed for autonomous (i.e., inherent enjoyment) or controlled reasons (i.e., external pressure), in comparison to goal contents, which explain if goals are pursued because they are inherently need satisfying or a means to another end (Sheldon, Ryan, Deci, & Kasser, 2004). In other words, goal contents refer to the "what" of motivation, or an individual's desires (i.e., to feel healthier). In comparison, motives refer to the "why" of motivation, or an individual's reasons for goal strivings (i.e., because my parent told me to exercise) (Ingledew & Markland, 2008). This suggests that it is possible for individuals to strive for the intrinsic goal of health because their doctor told them to, which represents a controlled motive. Conversely, individuals may exercise to look good to others, but they personally value appearance (e.g., not contingent on others' providing feedback), which creates striving for an extrinsic goal for autonomous reasons. Similar to studies on goal contents, investigations of motives for goal strivings have demonstrated variance among individuals' endorsed reasons for goal pursuits (Gillison et al., 2009). The following section

reviews outcomes associated with the endorsement of autonomous and controlled motives for goal strivings, followed by a description of studies exploring methods to influence individuals' uptake of autonomous motives for goal strivings. Limitations are then reviewed in the context of promoting autonomous motives for goal strivings within the current intervention.

2.4.3.2 Motives for goal strivings and the related outcomes. Grounded in self-determination theory (Deci & Ryan, 1985, 2000), the self-concordance model proposed by Sheldon and Elliot (1999) suggests autonomous motives for goal strivings lead individuals to spend a greater amount of time engaged in free-choice behaviours because strivings are aligned with individuals' values, interests, and enjoyment. Goal strivings for autonomous reasons are also posited to lead to greater engagement in behaviours to help others, which promotes satisfying relationships with others and feelings of relatedness (Sheldon & Elliot, 1999). Finally, autonomous motives for goal strivings are proposed to lead individuals to try harder to achieve goals, which is associated with greater experiences of success, which in turn is associated with increased competence levels. The accumulation of these need-satisfying experiences is proposed to result in feelings of volition over goals, which leads to long-term goal attainment and associated positive health outcomes (Sheldon & Elliot, 1999). In contrast, controlled motives for goal strivings are proposed to promote pursuits driven by external pressures and feelings of anxiety and guilt emerging from sources not integrated with the self (Sheldon and Elliot, 1999). Dependent on gaining rewards or others' approval, experiences of pressure to perform are greater, which is proposed to be associated with a lack of long-term goal commitment and goal attainment (Sheldon & Elliot, 1998, 1999).

Evidence for the relationships proposed in the self-concordance model were initially demonstrated in relation to university students' pursuits of self-generated academic goals

(Koestner, Lekes, Powers, & Chicoine, 2002; Sheldon & Elliot, 1998; Sheldon & Houser-Marko, 2001). More specifically, Sheldon and Elliot (1998) demonstrated that autonomous motives for goal strivings were positively associated with well-being, effort during goal strivings, and final goal attainment at 4-week follow-up, irrespective of individuals' expectancy and commitment. Confirming these findings, Sheldon and Houser-Marko (2001) later found endorsement of goals more aligned with personal values were positively associated with achievement of first semester goals, which led to greater engagement in autonomous motives for goal strivings and goal attainment for semester two goals. Koestner, Lekes, Powers, Chicoine (2002) further demonstrated that autonomous motives for goal strivings were positively associated with implementation intentions, which positively predicted university students' weekend goal progress (study 1) and monthly progress for New Year's resolutions (study 2).

Extending these findings to the health domain, in a cross-sectional study Maltby and Day (2001) showed university students who reported engaging in exercise for less than 6 months were more likely to have appearance-based exercise motives for goal strivings, which was positively correlated with indices of ill-being (e.g., social dysfunction, somatic symptoms, depression, and anxiety) and lower levels of self-esteem. Conversely, those engaged in exercise for a duration longer than 6 months were more likely to have enjoyment motives for goal strivings, which was positively related to well-being and self-esteem (Maltby & Day, 2001).

In a series of three studies examining university students' self-generated goals for leisure-time (Study 1), academics (Study 1 and 2), and body weight (Study 3), Koestner, Otis, Powers, Pelletier, Gagnon (2008) demonstrated autonomous motives for goal strivings at baseline were associated with higher goal attainment at 1-month follow-up across all

domains, whereas controlled motives were unrelated. Similarly, in a sample of university students (*n* = 205; *M* age = 19.5), Carraro and Gaudreau (2011) found self-generated semester goals for academics and physical activity that were more aligned with autonomous motivations were positively associated with goal attainment at 1-month follow-up. These findings were consistent with studies conducted with samples of adult athletes, which demonstrated autonomous motives for goal strivings positively predicted effort, which in turn positively predicted goal attainment in the short-term and long-term (A. L. Smith, Ntoumanis, & Duda, 2007; A. L. Smith, Ntoumanis, Duda, & Vansteenkiste, 2011).

Analysing qualitative reports of women's (*n* = 59; *M* age = 45.6) goals to achieve related to physical activity and reasons for attaining these goals, Segar, Spruijt-Metz, and Nolen-Hoeksema (2006) found women who reported body shape motives for goal strivings (i.e., related to toning, shaping, and weight loss) also reported engaging in significantly less physical activity than women reporting non-body shape motives for goal pursuits. Replicating and extending findings from cross-sectional data, Segar, Eccles, and Richardson (2008) used a prospective design to assess the relationship between women's (*n* = 156; *M* age = 49.3) motives for goal strivings in relation to physical activity and engagement in physical activity at 1-month and 1-year post-baseline. Women who aligned their reasons for attaining physical activity goals with well-being were more likely to continue engaging in physical activity than women who were motivated to lose weight (Segar et al., 2008). In addition, women who were motivated to be physically healthy demonstrated lower levels of physical activity (Segar et al., 2008), which suggests that motivations for goal strivings guided by physical health may be experienced as controlling if not aligned with one's interest, but rather felt as a pressure from an external source (i.e., doctors) (Williams, 2002). Corroborating and extending these findings, in a sample of adults (*n* = 204; *M* age = 33.3),

Moller (2012) demonstrated that financial motivation to achieve intervention weight-loss goals was unrelated to initiation of healthy changes (composite score for fruit/veg intake, fat intake, physical activity, and sedentary behaviour) during the intervention, healthy lifestyle improvement initiation, attainment of weight-loss goals, and maintenance of weight changes at 17-week follow-up.

Examining the relationship between healthy eating behaviours and motives for goal strivings in a cross-sectional sample of female university students (*n* = 205; *M* age = 22.65), Vartianian et al. (2012) found endorsement of appearance-based motives to attain exercise and weight-loss goals were positively associated with body image concerns, whereas health-related motives for exercise goals were negatively associated with body image concerns. Similarly, in a sample of adolescent females (*n* = 244; *M* age = 14.6), Verstufy, Vansteenkiste, and Soenens (2012) demonstrated appearance-focused goals underlying eating regulations were positively related to need satisfaction (e.g., for diet), body dissatisfaction, and bulimic symptoms, whereas health-focused motivations for goal strivings were unrelated.

Motives for goal strivings have also been shown to be a better predictor of engagement in healthy lifestyle behaviours during the pursuit of multiple goals. For instance, Jung and Brawley (2010) found more frequent exercisers equally valued their non-exercise goals and spent equal time in these goal-related activities, but reported placing greater value on their exercise goals in comparison to individuals with lower levels of exercise engagement. Further, evidence has shown the pursuit of physical activity behaviours coincides with engagement in healthy eating behaviours (De Vries, Kremers, Smeets, & Reubsaet, 2008), rather than counteracting these behaviours. Given changes in physical activity behaviours do not occur in isolation, but rather are likely to be undertaken in the context of other health-related behaviours (e.g., healthy eating) and life goals (e.g., friends, family, work),

including goal motives in the pursuit of goal directed behaviour is likely to overcome the potential for goal conflict, by ensuring set goals reflect healthy lifestyle behaviours that are valued.

Evidence of the positive outcomes associated with the pursuit of goals that are autonomously motivated suggests individuals are likely to benefit from environments that promote goal pursuits motivated by autonomous reasons (i.e., Koestner et al., 2008; Segar et al., 2008). Given the importance of endorsing autonomous motives for goal strivings, studies have more recently sought to explore the effectiveness of manipulating motives for goal strivings. Outcomes from these studies are reviewed in the section below within the context of promoting autonomous motives for goal strivings in the current intervention.

2.4.3.3 Framing motives for goal strivings. The need to identify casual influences of motives for goal strivings on goal attainment has been noted in the literature (i.e., A. L. Smith et al., 2011), yet there remains a limited number of experimental studies investigating outcomes associated with motives underlying goal pursuits (Ntoumanis et al., 2013). More specifically, previous experimental studies grounded in self-determination theory have primed general tendencies for autonomous and controlled motivations, but only one study to date has primed motivation for pursuing a specific behaviour goal. Results from studies examining general motivational tendencies have shown subliminal priming manipulations are capable of successfully manipulating perceived behavioural regulations and subsequent behaviour engagement and performance on motor and non-motor related tasks (i.e., Banting, Dimmock, & Grove, 2011; Friedman, Deci, Elliot, Moller, & Aarts, 2010; Hodgins, Yacko, & Gottlieb, 2006; Levesque, Copeland, & Sutcliffe, 2008; Radel, Sarrazin, Jehu, & Pelletier, 2013; Radel, Sarrazin, & Pelletier, 2009). These findings suggest adaptive outcomes are likely to be associated with priming for motives underlying goal strivings.

The only study to date to explore motivation priming in relation to goal strivings was examined in a sample of athletes (*n* = 84; *M* age = 19.63) asked to perform an incremental intensity task on a cycle ergometer (Ntoumanis et al., 2013). Manipulation of motives for goal strivings were delivered through participants' observation of a video showing an actor describing his/her (gender matched) involvement in an unrelated study with regard to autonomous (i.e., enjoyment, personal gain) or controlled (i.e., guilt) motives endorsed for working toward a goal (Ntoumanis et al., 2013). Results demonstrated autonomous, versus controlled, primed motives for goal pursuits were positively associated with interest in persistence and future goal engagement (Ntoumanis et al., 2013). Persistence was also indirectly related to greater future interest through changes in positive affect. Further, autonomous versus controlled motives for goal strivings were also shown to indirectly predict positive affect via persistence (Ntoumanis et al., 2013).

In contrast to Locke and Latham's (1990) goal setting theory, which suggests goal difficulty alone predicts motivation, these findings provide evidence for the need to consider motivations underlying the goal striving process. As such, having a goal set within Locke and Latham's (1990) proposed framework may be beneficial, but may be more likely to elicit motivational changes necessary to promote long-term behaviour engagement if considered alongside autonomous motives for goal strivings. Given BMI is negatively associated with autonomous motives for goal strivings related to healthy lifestyle behaviours (Markland & Ingledew, 2007), interventions must therefore consider not only providing a structure for implementing goal setting techniques (e.g., difficulty, specificity, and proximity) outlined in line with Locke and Latham's (1990) goal setting theory, but must also directly address individuals' reasons for goal strivings, or their motives, in order to maximize the benefits of setting a difficult goal (Duncan, Hall, Wilson, & Jenny, 2010).

Findings from both priming motives for goal strivings and general motivational tendencies indicate that brief exposure to manipulations to motivations for goal pursuits can influence individuals' endorsed motives for behaviour goals (Banting et al., 2011; Ntoumanis et al., 2013; Radel et al., 2009). However, these propositions have yet to be explored in relation to long-term behaviour engagement and the pursuit of multiple goals. In accordance with literature from goal setting theory, changes in healthy lifestyle behaviours require sustained goal commitment (Maes & Karoly, 2005), and may therefore require repeated exposure to environments promoting autonomous goal strivings within the context of self-determination theory postulates (Gillison et al., 2013). In line with methods for promoting intrinsic goal contents, the current study sought to promote the endorsement of autonomous, rather than controlled motives for goal strivings. Instructors were trained to provide rationale for considering autonomously motivated goal strivings, rather than controlled, and to deliver goal setting instructions and examples that reminded participants to review their goal in the context of autonomous motives. For instance, an example of autonomous goal striving for adolescents was, "I enjoy playing sports with my friends and walking with my mom" and for parents, "I enjoy being active with my teen and seeing him/her be active with friends" (see sections 3.7.2 and 3.7.3). In line with instructor training, participants learned rationale for reflecting on motives for goal strivings, and received examples and structured means for including autonomous motives for goal pursuits in their set behaviour goals (see sections 3.7.2 and 3.7.3).

2.4.4 Considering goal contents and motives for goal strivings. Evidence from the literature on goal contents and motives for goal strivings clearly demonstrates the benefits of considering both contents and motives within an individual's goal striving framework (Gaudreau, Carraro, & Miranda, 2012; Koestner et al., 2008). The literature reviewed until

this point has however addressed the independent contribution of each. The aim of the current section is to review studies to date that have explored hypothesised models addressing outcomes in relation to the inclusion of both contents and motives related to goal strivings.

Within self-determination theory, goal contents and motives for goal strivings are proposed to be two independent processes both underpinned by need satisfaction (Deci & Ryan, 2000). Despite evidence demonstrating contents and motives are both underpinned by need satisfaction (i.e., Sebire et al., 2009; Sheldon & Elliot, 1999), recent findings suggest psychological outcomes are independently predicted by goal contents and motives for goal strivings (Sheldon et al., 2004), whereas contents predict behavioural outcomes through motives (Sebire, Standage, & Vansteenkiste, 2011).

Sheldon, Ryan, Deci, and Kasser (2004) initially reported on a series of three studies demonstrating the distinct contribution of goal contents and motives for goal strivings in predicting psychological outcomes in samples of university students. In the first study, participants (*n* = 714) rated the degree to which intrinsic (e.g., emotional intimacy, community contribution, and personal growth) and extrinsic (e.g., financial success, attractive image, and fame/popularity) reasons for goal pursuits would contribute to their motivation for pursuing each goal, and how happy they would be when pursuing the nominated goal. Participants (*n* = 221) in the second study rated the degree to which motives for their self-generated goals (later coded as autonomous or controlled) contributed to their goal pursuits, the extent to which each goal might help to bring about six “possible futures” (e.g., goal contents), and their current level of subjective well-being. In the third study, participants (*n* = 244) rated their goal contents, motives for goal strivings, and well-being in relation to post-graduation goals (e.g., 1-year follow-up). Across all

studies, intrinsic and extrinsic goal contents were positively correlated with autonomous and controlled motives for goal strivings, respectively, and both goal contents and motives for goal strivings independently predicted well-being outcomes (Sheldon et al., 2004).

Commensurate with these findings, Sebire, Standage, and Vansteenkiste (2009) demonstrated in a cross-sectional sample of adult council employees (*n* = 410; *M* age = 41.39) that the predicted path from goal contents to physical self-worth, psychological well-being, and exercise anxiety remained significant when motives for goal strivings were considered. In contrast, the independent effects of goal contents beyond motives for goal strivings was no longer present when behaviour outcomes were predicted. Motives for goal strivings were instead shown to mediate the relationship between goal contents and self-reported exercise behaviours (Sebire et al., 2009). Departing from previous evidence shown with regard to psychological outcomes (Sheldon et al., 2004), the finding that behaviour outcomes were indirectly predicted by goal contents (Sebire et al., 2009) was consistent with the model forwarded by Ingledew and Markland (2008) in which goal contents are an antecedent to behavioural regulations for goal strivings, which in turn predicts behaviour engagement. More recent objective measures of physical activity (e.g., 7-day accelerometer) in a sample of adults (*n* = 101; *M* age = 38.79) have also supported the predictive pathway from goal contents to behaviour outcomes, through motives for goal strivings (Sebire et al., 2011).

Evidence of the independent and mediational effects of motives for goal strivings on behavioural and psychological outcomes, respectively, suggests interventions are likely to enhance goal attainment when individuals are prompted to consider both contents and motives underlying their goal strivings (Sebire et al., 2009). The current study therefore sought to address previous shortcomings in the literature by integrating self-determination

theory (Deci & Ryan, 2000) with goal setting theory (Locke & Latham, 1990) by considering participants' goal contents and motives for goal strivings as modifiable mechanisms in addition to goal difficulty, specificity, and proximity. Incorporating the distinctions made in self-determination theory is likely to assist in overcoming the problem of individuals' goal selection potentially thwarting their psychological needs within the traditional goal setting framework proposed by Locke and Latham (1990). Set goals are therefore more likely to be closely aligned with one's self-determined motivational orientations, and were thus posited as more likely to be enacted, as self-determined motives are strongly linked with self-regulation and behaviour persistence. To ensure participants received need-supportive instructional environments and were encouraged to set intrinsic goals and endorse autonomous motives for goal strivings, instructors' demonstrations of these behaviours were assessed for intervention fidelity.

Chapter 3

Methods

3.1 Introduction

The current study was conducted in the context of a broader project, Curtin University's Activity, Food and Attitudes Program (CAFAP). Primary outcomes addressed in CAFAP included adolescent behaviour changes for physical activity and healthy eating, and secondary outcomes addressed adolescent psychological outcomes for health-related quality of life and depressive symptoms (Straker et al., 2012). Aims of the current study were to test effects of an intervention based on the integration of self-determination theory and goal setting theory and to explore the mechanisms that underpinned the action of the trial on adolescent healthy lifestyle behaviours and psychological outcomes. Intervention fidelity was also assessed to determine whether participants received the intended intervention.

Effects of the intervention were determined in relation to the following variables:

- Adolescent perceived parent support for physical activity (2.1) and healthy eating (2.2)
- Adolescent autonomous motivation for physical activity (2.3) and healthy eating (2.4)
- Adolescent physical activity (objective 2.5) and healthy eating (objective 2.6)
- Adolescent quality of life (psychosocial, physical, and health) (objective 2.7) and depressive symptoms (2.8)
- Parent autonomous motivation to support adolescent physical activity (objective 2.9) and healthy eating (2.10)
- Parent demonstration of need-supportive behaviours (2.11)

Mechanisms underlying changes following intervention delivery were explored in relation to adolescents' and parents' autonomous motivation based on concepts from the integration of self-determination theory and goal setting theory. A series of mediation models were proposed to address objectives stipulating the underlying mechanisms, and included the following hypotheses:

- changes in adolescent autonomous motivation were hypothesised to explain the relationship between changes in adolescent perceived parent support and changes in the following adolescent outcomes:
    - physical activity behaviours (objective 3.1)
    - healthy eating behaviours (objective 3.2)
    - health-related quality of life (objective 3.3)
    - depressive symptoms (objective 3.4)
- changes in parent demonstration of support behaviours were hypothesised to explain the relationship between changes in parent autonomous motivation to support adolescent behaviour engagement and changes in the following adolescent outcomes:
    - perceived parent support (objectives 3.5, 3.6)
    - physical activity behaviours (objective 3.5)
    - healthy eating behaviours (objective 3.6)
- changes in adolescent autonomous motivation were hypothesised to explain the relationship between adolescent goal attainment and changes in the following adolescent outcomes:
    - physical activity behaviours (objective 3.7)
    - healthy eating behaviours (objective 3.8)

- changes in parent autonomous motivation to support adolescent behaviour engagement were hypothesised to explain the relationship between parent goal attainment and changes in the following adolescent outcomes:
    - physical activity behaviours (objective 3.9)
    - healthy eating behaviours (objective 3.10)

The current chapter describes methods used to address objectives of the current study within the context of the broader intervention. A description of recruitment procedures, study sample, and the intervention study design are therefore included to provide an understanding of the framework in which content was delivered to promote the motivational mechanisms explored in the objectives of the current study. Program content, methods for delivery of resources, and assessment instruments specific to the current study are also described. In order to maximise the benefits of investigating outcomes associated with the integration of self-determination theory and goal setting theory, the description of methods used to implement content aligned with theoretical underpinnings is described at a level necessary to allow for effective evaluation and replication of behaviour change techniques (Abraham & Michie, 2008).

3.2 Study Design

CAFAP (Australian New Zealand Clinical Trials Registry ACTRN 12611001187932) was delivered using a waitlist controlled, staggered cohort entry design (see Figure 2). Staggered implementation was employed to control for external influences such as seasonal and public events that were likely to confound intervention effects. Participants[1] completed baseline assessments then waitlisted for one school term (three months) to provide a within-participant control period. Post-waitlist assessments were completed immediately prior to the program start and follow-up assessments were completed immediately after the

intensive program and at 3, 6, and 12 months after program conclusion. Cohorts were implemented in three waves across metropolitan and regional Western Australia. Program sites were designated in suburbs with a low socio-economic demographic that maintained facilities where the intervention could be implemented in the future. The first two waves were conducted at south and east metropolitan locations in Perth, and the third wave consisted of both metropolitan locations and a regional location in the south western region of Western Australia. During the 12-month follow-up period, adolescents were contacted at three decreasing levels of intensity via short messaging service (SMS) and phone calls.

3.2.1 A priori power analysis.[2] A priori power analysis for the current study was conducted based on a path analytic regression model with non-latent manifest variables and a medium effect size ($f^2 = .15$) for two predictor variables (independent variable and mediator) on the dependent variable, consistent with effect sizes reported in a meta-analysis of the self-determination theory literature (Ng et al., 2012). Assuming 80% power at a 5% level of significance, a sample size of 68 was needed at 12-month follow-up. Based on 33% attrition in the CAFAP pilot study (K. L. Smith et al., 2011) and 13% attrition reported in longitudinal interventions in obese populations (Silva, Vieira, et al., 2010), attrition at 12-month follow-up was assumed to be 20% for the current study. Allowing for 20% attrition, 85 participants were required at entry.

An a priori power analysis was also conducted for the proposed within-participant repeated measures ANOVA based on the same effect size, power, and alpha level stated previously. Given a 20% attrition rate, 69 participants needed to be recruited to obtain the 55 participants required to obtain a medium effect size when conducting one-way repeated measures ANOVAs. The proposed number of participants for the current study was

consistent with those needed to evaluate outcomes of the broader study (see Straker et al., 2012).

3.2.2 Ethics. Prior to commencing the study, ethics approval was sought for CAFAP through the Curtin University Human Research Ethics Committee. Approval for the initial protocol (HR105/2011) was granted on 7 September 2011 (see Appendix B), and amendments were approved on 11 November 2011 (see Appendix C). Ethical approval was renewed annually for the two years following initial approval of the study (see Appendix D and Appendix E).

Following ethical approval, participants were recruited to the study in three waves. Adolescents and their parents interested in participating were given an information letter (see Appendix F) and asked to provide written consent (see Appendix G) prior to participation. The information letter outlined confidentiality, benefits, risks, expectations of participation, audio recordings of sessions for intervention fidelity (waves 2 and 3), and the right to withdraw from the study at any time without negative repercussions. Risks included potential embarrassment from undergoing body measurements during assessments, thinking and talking about issues during the intensive program, and injury from engagement in physical activity during intensive program sessions and at home. Risks were minimized by offering supportive group discussions with the option for individual discussions, completing measurements in a separate room (e.g., individual), and providing instruction on how to exercise properly to reduce injury risk. A protocol was also in place to assist in managing behavioural incidents (see Appendix H). Participants were made aware that involvement in the study included attendance at bi-weekly sessions for the duration of the 8-week intensive program, as well as completion of assessments at six different points during the study.

Participants were also given the opportunity to ask questions about their involvement in the study prior to consenting to participate.

3.3 Participants

Overweight and obese adolescents were recruited through the health system, local high schools, and from the general community. Paediatric specialists and allied health professionals at children's hospitals and general medical practices located near program areas were asked to identify potential volunteers and provide options for referrals. Recruitment messages were listed in school newsletters and recruitment flyers were provided to key staff (i.e., school nurses) for distribution to potential participants. General community members were informed of the study via community newspapers, radio mass media messages, and letter box drops at houses surrounding program locations. Recruitment messages targeted overweight adolescents interested in getting fit, gaining energy, and losing weight (see Appendix I).[3]

Volunteers were eligible to participate if they were between 11 to 16 years of age, had a gender and age corrected BMI greater than the 85th percentile (Kuczmarski et al., 2000), passed screening conducted by a medical practitioner, were willing to attend twice weekly sessions (during the 8-week intensive program) and all waitlist (e.g., entry and pre-program) and follow-up assessments (during the 12-month post-intervention period), and were not currently receiving treatment for a psychological disorder, or obese due to a medical disease or genetic reasons.

3.4 CAFAP Intervention Overview

CAFAP was delivered in local community settings by multi-disciplinary teams including physiotherapists/exercise physiologists, dieticians, and psychologists. The intensive program was conducted over an 8-week period consisting of two hour bi-weekly

sessions conducted on Monday and Thursday evenings and attended by adolescent and parent pairs (see Table 1).

Each intensive program session included a 45-minute exercise class for adolescents consisting of aerobic, strength, and coordination activities. During this time parents attended education sessions addressing adolescent development, relationships with adolescents, need-supportive behaviours, and practical skills for supporting adolescents' healthy lifestyle behaviour changes (i.e., community resources, food budgeting, and a supermarket visit). Informal support was also available to parents in 'walk and talk' sessions with instructors and other participating parents.

The second hour of each session was conducted jointly with adolescents and parents and focused primarily on healthy eating (i.e., energy balance, preparing meals and snacks, food labelling), physical activity (i.e., healthy activity and family activity), goal setting strategies, overcoming barriers, coping with mood fluctuations, and family relationships. The intensive 8-week period concluded with a healthy cooking celebration inclusive of parents, adolescents, and instructors from all disciplines.

During the 12-month follow-up phase, participants were contacted at various levels of intensity via SMS and phone calls to prompt goal setting and behaviour maintenance (discussed in sections 3.5 and 3.7.5). Intervention fidelity was monitored through rater-observations of sessions at multiple points during each wave (discussed in section 3.8.1).

3.5 CAFAP Intervention Development

The protocol for the broader study (Straker et al., 2012) was based on a pilot study of CAFAP conducted in 2010 at Curtin University. The pilot study adapted a tertiary hospital based program (Princess Margaret Hospital 'Fitmatters' Program) for delivery in a community-based setting by a multi-disciplinary team (K. L. Smith et al., 2011). Following

the pilot study, intervention content was modified based on outcomes from focus groups and interviews conducted with past participants, potential participants, and researchers/progression stakeholders as part of the larger CAFAP study (K. L. Smith, Straker, McManus, & Fenner, 2014). Findings indicated the need for a stronger theoretical basis aligned with goal setting and environmental factors associated with motivation to achieve set goals (K. L. Smith et al., 2014). Content was subsequently revised to reflect concepts underpinned by the integration of self-determination theory and goal setting theory (Fenner, Straker, Davis, & Hagger, 2013).

Intervention content specific to the current study was written by the author and delivered in adolescent sessions 5, 6, and 15 (see Appendix J for adolescent session handbooks) and parent sessions 3, 5, 6, and 15 (see Appendix K for parent session handbooks). Adolescent sessions addressed methods for goal setting and content for taking adolescents through various stages of goal setting from the initial behaviour changes to progress made during the intensive program and goals for the post-program period. Parent session 3 introduced three basic needs for adolescents and provided parent behaviours (e.g., autonomy support, structure, and involvement) for supporting these needs. Sessions 5, 6, and 15 introduced parents to methods for setting goals to support goals set by adolescents, and guided parents in setting their support goals at key stages including initial goals and goals set after the conclusion of the intensive program period.

Additional intensive program sessions that formed part of the broader study were written by project team members consisting of a registered psychologist, physiotherapist (e.g., director of CAFAP/co-supervisor of the author), and dietician (e.g., a senior dietician completing her doctoral thesis on components of CAFAP). Content written by registered psychologist team members (parent sessions 4, 7, 9, 12, 14) reinforced content addressing

need-supportive behaviours introduced in parent session 3. For example, the four types of parenting styles (e.g., permissive, authoritarian, authoritative, uninvolved) were explained in session 9 by the degree to which structure and involvement are provided. Nutrition and physiology content delivered by dietician and physiotherapist instructors was written by project team members using need-supportive language that encouraged goal striving in the context of autonomously motivated health outcomes. All sessions were reviewed by the author to ensure concepts were in line with rationale based on self-determination theory and goal setting theory to promote aims of the current study.

The standardised list of SMS messages (see Appendix L) used in the maintenance phase was developed by the project physiotherapist and dietician, and modified by the author to ensure messages conveyed a need-supportive context with an emphasis on intrinsic contents and autonomous motivates for goal strivings. For instance, an example of a message targeting fruit was as follows: “Think about how many bits of fruit U had today. If U had less than 2, you could try to add in 1 more piece tomorrow. How about some fruit on your cereal in the morning?”

3.6 Instructor and Follow-up Facilitator Training

3.6.1 Instructor training. In total, six psychologists, three physiotherapists, one exercise physiologist, and three dieticians were trained to deliver CAFAP across three waves (see Table 2). Training sessions were held prior to each wave to accommodate instructors new to CAFAP. After the conclusion of wave 1, some previously trained facilitators were not able to continue leading the program and thus replacements were trained. Wave 3 training was held to facilitate the introduction of instructors at the regional location.

Training sessions were held at Curtin University for instructors at metropolitan locations and via Skype for instructors at the regional location given distance needed to

travel to the south western region of Western Australia (~730 km) was not viable for a brief training session. Regional instructors met jointly at a house self-nominated by one of the instructors. All trainings were conducted in a group format at the respective metropolitan and regional locations.

Wave 1 training was delivered across two sessions, each totalling an hour and a half in length. The first half hour was devoted to introducing instructors to the program and covering administrative matters (i.e., signing contracts, confirming registration in respective disciplines, verifying Police Clearances and government clearance check requirements for working with children, and organising payroll details), followed by a half hour addressing program rationale and structure (Appendix M), and a final 30-minutes focused on need-supportive behaviours (Appendix N). The initial hour of the second session was devoted to goal setting techniques and methods for implementation (Appendix O), with the last half hour dedicated to answering questions and discussing logistics of overall program delivery. Content addressing self-determination theory concepts and goal setting methods were conducted by the author and program rationale and structure were delivered by the physiotherapist and dietician project team members. Two instructors were not able to attend one of the two sessions and viewed recorded footage of the respective session missed. Three psychologists were trained to accommodate a pair of psychologists who delivered content in a single location during wave 1 (e.g., one led all Monday or all Thursday sessions at the east metropolitan location). Wave 2 and wave 3 instructors attended a single training delivered over two and a half hours. The format reflected that used during the wave 1 training with the exception of a half hour for administrative matters, which was covered external to the training. All content was delivered solely by the author for instructors trained at waves 2 and 3.

3.6.1.1 Instructor training content (see Footnote 2). Development of intervention content was based on relationships among behaviour-change techniques and the associated change mediators and subsequent change outcomes proposed in the current study. Methods used in mapping behaviour-change techniques on to the associated change outcomes are outlined in Table 3 and Table 4. Components and implementation methods developed based on these processes are described in the sections below.

3.6.1.2 Instructor training: Autonomy support, structure, and involvement (see Footnote 2).

Training instructors in need-supportive behaviours was presented as serving a dual-purpose by providing instructors with the skills and stylistic elements to firstly deliver the program content using need-supportive behaviours and secondly to provide parents with the knowledge and skills to support and complement the instructors' need-supportive delivery of content to foster a need-supportive relationship with adolescents (see Appendix N). Concepts were described as applying to all individuals, with specific examples focused on instructor/participant interactions. Instructors were asked to combine their understanding of these learning processes with the highly structured intervention program content to form their training on how to assist parents in adopting and utilizing need-supportive behaviours.

Training opened with a rationale for using behaviour-change techniques by detailing the relationship between these techniques and change outcomes. Need-supportive behaviours were then introduced as a means for achieving change outcomes by increasing adolescents' autonomous motivation to perform healthy lifestyle behaviours and parents' autonomous motivation for behaviours to support adolescents' healthy lifestyle changes. Behaviours required to provide need-supportive environments were described as shown in Table 5 (Edmunds et al., 2007).

Rationale and examples of how behaviour-change techniques might appear in the intervention were also provided for each sub-behaviour comprising autonomy support, structure, and involvement. For instance, to make participants feel they belong and are important, instructors were encouraged to talk 'with' participants by redistributing classroom dynamics to sit at participants' level and/or by standing in the middle amongst participants instead of lecturing in the front of the room.

Participant needs were then described and parallels drawn between instructor behaviours and the needs they directly support to help illustrate how behaviour-change techniques mapped on to change mediators. Subsequent examples were provided to clarify what each need might look like and to illustrate possible outcomes for both adolescent and parent participants. For instance 'feeling they can choose for themselves' was described as: "adolescents choose to play soccer because they enjoy it, not because their parents tell them to play; and parents choose to go for a walk with their adolescents because they value their adolescents' health".

Concepts were further highlighted through discussions of instructor-generated examples of need-satisfying behaviour demonstrations and instances of participant needs being met. In addition, instructors were asked to observe a role play and discuss instances when need satisfaction and behaviours to support these needs were demonstrated. Instructors were also asked to demonstrate behaviours in pairs to ensure they understood participants' experiences of need satisfaction and the instruction style required for leading intervention sessions. Feedback on instructors' demonstration of need-supportive behaviours was provided with additional suggestions given as required. The training session concluded with distribution of take-home materials covering descriptions and examples of

instructor behaviours and participant needs, as well as empirical evidence addressing the relationship between need-supportive behaviours and maintenance of behaviour changes.

3.6.1.3 Instructor training: Goal setting (see Footnote 2). Goal setting was introduced to instructors as a strategy for assisting participants to implement and maintain autonomously-motivated behaviours (see Appendix O). Types of goals participants were asked to set were first described, followed by rationale for each goal type and methods for taking participants through goal setting processes. Weekly subgoals were described as a means for making the task seem more manageable; specific goals as enabling frequent assessment of progress; and difficult goals as enhancing concentration and persistence. Setting goals in the context of intrinsic and autonomous goal strivings was explained as a method for enhancing autonomous motivation, which was more likely to lead to goal attainment.

Instructors were asked to convey similar rationale to participants, along with taking participants through goal setting sheets (see Appendix P) that provided a step by step format for setting goals based on methods proposed in self-determination theory and goal setting theory. A more detailed description of these methods is provided in adolescent (section 3.7.2) and parent (3.7.3) goal setting sections outlined under program components.

Instructions on how to guide participants through the sheets was provided followed by a role play demonstrating behaviours (e.g., taking participants through steps for listing reasons ('why' and 'what') and setting difficult, specific, proximal /distal goals) and the opportunity to practice behaviours. Take-home materials included scripted program content to deliver goal setting sessions and empirical evidence supporting goal setting strategies. Instructions included during training and within the program content emphasised the

importance of phrasing environments to encourage goal strivings related to health outcomes and participant enjoyment.

3.6.1.4 Instructor training: Booster sessions (see Footnote 2). Following rater-assessed sessions (e.g., twice per wave), instructors were provided feedback on their delivery of need-supportive behaviours and communication encouraging the setting of intrinsic goal contents and autonomously motivated goal strivings. Feedback was specific to each instructor's unique provision of need-supportive behaviours, highlighting specific strengths and areas for improvement (Tessier et al., 2008). Individual review sessions were conducted by the author via face-to-face immediately following observation or via telephone in the week following observation (see Section 3.9.2 for full description).

3.6.2 Facilitator phone call support training. Phone call support was conducted in metropolitan cohorts by the author, project research officer (a physical education teacher), and project dietician, and in the regional cohorts by the dietician and physiotherapist instructors. All phone call support staff were made aware of the following objectives to be conducted in a need-supportive context that encouraged intrinsic goal contents and autonomously motivated goal strivings: reviewing and setting new goals; discussing experiences of implementing behaviour changes for physical activity and healthy eating, and providing support for goal strivings by reviewing content addressed during the intervention.

The project research officer was trained by the author in need-supportive methods to use during phone conversations with adolescents. Training mirrored methods delivered to instructors and included: a description of need-supportive behaviours; generation of examples; role-play between the project research officer and author with suggestions on improvements as necessary; rationale and methods for guiding participants in setting intrinsic and autonomous goals; and take home materials outlining concepts. The remaining

staff relied on their previous training received either during the rater training (see Section 3.8.1) or instructor training. A reminder of strategies for employing need-supportive behaviours and prompts to use as a guide during phone conversations was distributed to team members providing support calls (see Appendix Q).

3.7 Parent and Adolescent Training and Follow-up

3.7.1 Parent training: Autonomy support, structure, and involvement (see Footnote 2).

Training was delivered to parents in a single program session, totalling 50 minutes in length (see Appendix K). Two 15-minute segments were dedicated to content addressing adolescent needs and parent behaviours to support these needs. The session concluded with 20 minutes allocated for parents' reflection on their understanding of need-supportive concepts. Parent need-supportive behaviours were introduced as a means to foster adolescents' autonomous motivation to engage in behaviours to improve their health and physical fitness. Adolescent needs were then mapped on to each behaviour to explain the relationship between parent behaviour-change techniques and adolescent outcomes. Adolescent needs and parent need-supportive behaviours were then described in line with content delivered in the instructor training, with slight modifications made to reflect instances unique to adolescent/parent relationships (i.e., providing structure by "modelling positive behaviour to your adolescent by setting and following through with your goals").

Examples of needs and need-supportive behaviours were then provided, for instance: give adolescent options for being active with parent (autonomy support); ensure fruit is available (structure); and spend time each day talking about adolescent's day (involvement). An instructor then illustrated concepts in a scripted role play with a parent volunteer, while remaining parents worked as a group to generate examples of instances in the role play when support behaviours were demonstrated and how needs mapped on to

these behaviours. Responses were discussed and instructor feedback provided that highlighted appropriate responses and offered corrections when needed. Parent reflection concluded the session, which allowed parents to discuss concepts learned to ensure they felt comfortable applying behaviours in the home environment. Material outlining concepts and examples of needs and behaviours comprising autonomy support, structure, and involvement were provided to supplement instruction and to assist in reinforcing behaviours in the home environment (see Appendix K).

Methods for delivering behaviours in the home environment were also reinforced through program content each week. For instance, autonomy support was described in the session for overcoming barriers (e.g., exploring behaviour options); structure was explained as the basis for the topic of meal planning and setting house rules; and parenting styles were described along a continuum ranging in the degree of structure and involvement provided. In each instance particular attention was afforded to address parents' management of the commonly used method of rewards. Behaviour options, for example, included reviewing pros and cons of rewards and need-supportive alternatives, and descriptions of behaviours associated with parenting styles explored the role of rewards. In particular, parents were encouraged to arrive at means to use rewards as incidental to behaviour change rather than its focus, consistent with self-determination theory that suggests that rewards can have an informational rather than a controlling function (Hagger et al., 2013). Each week, parents also had the opportunity to discuss experiences related to implementing the behaviours.

3.7.2 Adolescent training: Goal setting. Adolescents were introduced to goal setting methods over two sessions (e.g., sessions 5 and 6; see Appendix J). In the first session adolescents were provided goal setting booklets (see Appendix R) that included an

introduction page, helpful hints, suggested weekly goals, overall goal matrix, examples of setting weekly goals, and weekly goal setting sheets for the duration of the intensive program. The introduction page provided descriptions and rationale for goal setting methods and was followed by a helpful hints page detailing examples of junk food, fruit, and vegetable serving size portions, as well as definitions for sedentary behaviour, light/incidental physical activity (e.g., step counts), and moderate-to-vigorous physical activity.

The overall goal setting matrix was marked with adolescents' current behaviour levels, and included space for adolescents to record goals to reach by the end of the program (e.g., overall goals). Overall goals were classified into the following: moderate-to-vigorous physical activity, steps, screen time, fruit serves, vegetable serves, and junk food serves. Goals related to sedentary behaviour (e.g., screen time) were included throughout to meet objectives of the broader study. The current behaviours were pre-recorded by the psychologist at each location based on a report from the project dietician outlining adolescent behaviours reported at entry (e.g., accelerometer and 3-day food diary data).

Suggested goals provided options for adolescents to choose if desired to align with guided goal setting methods. Examples of weekly goals referred to a completed goal setting sheet with goals set in the areas of physical activity, sedentary behaviour, healthy eating. Weekly goal setting sheets provided a format that prompted adolescents to record the following in line with the examples previously shown for weekly goals: challenge ratings (0-10 score to ensure goal difficulty), goal contents (e.g., "What do you want to happen by achieving your goal?"), motives for goal strivings (e.g., "Why is it important you achieve this goal?"), specific 'daily details' outlining what they will do each day to achieve their weekly

goal (e.g., Monday: Walk 1km at 5.30 p.m.), and weekly progress ratings (1-10 score indicating degree of attainment).

Instructors guided adolescents through the goal setting booklet by first introducing the benefits of goal setting and then detailing the rationale and methods used for implementation as shown in the introductory page of the goal setting booklet. Adolescents were made aware of the behaviour descriptions (i.e., helpful hints: 1 vegetable serve = ½ cup of cooked vegetables) and then advised of their entry behaviour levels indicated on their overall matrix. Instructors allowed adolescents to adjust their entry levels for behaviours, but emphasised that levels reported in their overall matrix were likely to be accurate as these were based on measures of physical activity (e.g., accelerometer data) and dietary intake (e.g., 3-day food diary) reported at entry. Once adolescents confirmed their entry levels of behaviours, adolescents were prompted to indicate their overall goals to reach by the end of the intensive program. Adolescents were encouraged to set realistic but challenging goals that could be readjusted as required, such as when goals were met.

The first session concluded with instructors guiding adolescents through setting their first weekly goal for sedentary behaviour. This included instructors asking adolescents to set their overall goal for sedentary behaviour, and to then set a smaller more manageable goal to achieve in the next week based on their overall goal by progressing through the outline presented on their blank weekly goal setting sheet (e.g., listing weekly goal, goal contents, motives for goal strivings, daily details, and challenge rating). Adolescents were encouraged to refer to the suggested list of weekly sedentary behaviour goals to help generate a weekly goal for sedentary behaviour. Adolescents were asked to implement their sedentary behaviour goals in the two days before the next session, at which point they would then be asked to set goals for physical activity and healthy eating. The lapse in time between

learning goal setting concepts and implementing goals related to behaviours across all healthy lifestyle areas was provided to allow adolescents to reflect on goal setting techniques to enhance learning of concepts in the second goal setting session.

In the second session, adolescents were encouraged to discuss their experiences of implementing sedentary behaviour goals, and asked to consider this reflection when setting goals for physical activity and healthy eating. Instructors again guided adolescents through setting weekly goals by first referring to overall goals, and then by providing collaborative support as adolescents completed the remaining sections on their weekly goal setting page in accordance with the format provided. During this time, instructors reminded adolescents of the goal setting techniques outlined on their introduction page, and encouraged adolescents to consider setting goals related to health outcomes motivated by enjoyment based on research showing that such goals were more likely to increase goal attainment and sustained behaviour change (Sebire et al., 2009; Vansteenkiste, Simons, Lens, Sheldon, et al., 2004). Once adolescent goals were set alongside instructor collaboration, parents joined to partake in setting goals to support behaviour change goals defined by adolescents (see parent goal setting for a further description). A description of how these practical strategies mapped on to goal setting techniques and the underlying theoretical framework are provided in Table 6.

Adolescents were asked for the remainder of the intensive program to work collaboratively with instructors to review their weekly goal progress and adjust their weekly goals in accordance with their progress and the goal setting methods previously addressed. In session 15 (e.g., near the end of the intensive program), adolescents reviewed progress made on their overall goals and were guided through setting overall goals to reach at 3-month follow-up as well as goals for the first week of the corresponding post-program

period. Goal setting booklets provided for the 3-month period were identical to those issued during the program, with the exception of additional weekly goal setting sheets to accommodate the longer time duration during the follow-up period. Goals set for the 6-month and 12-month periods included only the overall matrix due to all participants choosing to not consistently complete weekly goal setting sheets in the 3-month follow-up and instead choosing predominately to integrate goal setting methods into their daily lives without manually recording goals, but rather making themselves aware of their overall goals and maintaining previous behaviours to meet these goals.

3.7.3 Parent training: Goal setting. Goal setting content delivered to adolescents was modified to reflect setting goals for behaviours where parental involvement was paramount for adolescents' to achieve their goals (see Appendix K). Parent goal setting content therefore focused on assisting parents to set goals for their own behaviours that would support goals for behaviours set by adolescents. In the first of two sessions introducing goal setting, booklets for goal setting were provided to parents that mirrored those given to adolescents, with the exception of text amended to reflect goals for support behaviours (see Appendix S). For instance, the list of example goals to use a guide in setting weekly goals reflected behaviours related to parent support, such as "Have a healthy breakfast ready for my teen." Examples of specific details listed for weekly goals also included parent-specific behaviours such as "cook homemade dinner with two serves of vegetables", and weekly goals were structured so parents had to respond to the phrase, "My goal this week is to support my adolescent's goal to…"

Based on the same structure previously reviewed with regard to delivering goal setting content to adolescents, parents were instructed on how to set support goals in accordance with self-determination theory and goal setting theory (see Table 6). Instructors

began by reviewing the rationale and methods for goal setting, followed by reviewing definitions of adolescent behaviours parents would support (i.e., junk food serving size), examples of goals they might set each week to support their adolescents, and examples of how to set weekly goals with regard to supporting adolescent physical activity, sedentary behaviour, and healthy eating.

Parents were advised that each week adolescents would work collaboratively with instructors to set their weekly goals, and once complete would be joined by parents to allow adolescents to inform parents of their goals. Parents could then engage in discussions and set goals with adolescents that helped support adolescents' goals for behaviour changes. Instructors encouraged parents to incorporate autonomy support, structure, and involvement behaviours during goal setting discussions with adolescents, as well as to remind adolescents to maintain self-determined reasons for goal setting. A sheet of tips outlining these behaviours was provided and a scripted role play demonstrated to help illustrate how goal setting discussions might unfold (see Appendix K).

Parents were then asked to work in pairs to practice goal setting discussions with adolescents and setting parent support goals that mapped on to adolescents' goals for behaviour change. Using an example of an adolescent's goals for sedentary behaviour, parents took turns playing the role of the parent and adolescent, with the parent guiding the discussion to learn about the adolescent's goals and recording goals to support those set by adolescents. The first session concluded with asking parents to reflect on goal setting techniques and to consider goals they might want to set to support their adolescents when recommencing in the following session.

In the second session, adolescents and parents were guided through sharing overall goals set by the adolescent. This enabled parents to record adolescents' goals in their own

booklets so they could have an understanding of the overall goals they would work toward supporting. Instructors then guided adolescent/parent pairs through sharing adolescent weekly goals and setting parent weekly support goals. This process was then repeated once a week for the duration of the intensive program.

At the conclusion of the program, parents also recorded their progress on supporting adolescents' overall goals for the program and set support goals for the first week of the 3-month post-program period. Parents were asked to record adolescents' 3-month overall goals in their booklets to understand goals adolescents were working toward that required support from parents. A copy of adolescent overall goals set for the 6-month and 12-month post-program periods was provided to parents in accordance with procedural reasons described with regard to adolescent goal setting.

3.7.4 Instructor involvement: Flow of goal setting delivery during program. Following the first goal setting session, adolescents and parents reported difficulty in the uptake of goal setting methods and their queries could not be sufficiently met by one instructor. In addition to the psychologist scheduled to deliver the goal setting content, dietician and physiotherapist instructors were asked to attend the initial goal setting session during wave 2 and wave 3 to assist in responding to queries. Weekly follow-up sessions across all waves were also amended such that the 10-minutes allocated for goal setting was increased to 20-minutes to allow enough time for participants to adequately review goals and address concepts integrated from self-determination theory and goal setting theory.

3.7.5 Goal setting: Follow-up contact. Adolescents and their parents were asked to provide a preferred contact number and days/times of the week to receive SMS and phone calls during the 12-month follow-up period. Contact was made at three levels of intensity during the 12 months following program delivery. In the first three months following

program completion, contact was made via SMS three times a week, then once a week for an additional three months, and finally monthly messages were sent during the last six months, totalling 56 messages over the 12 months. Intensity of phone contact was also tapered, beginning with bi-monthly contact in the first three months, followed by monthly contact during the 6-month phase, and finally phone contact was made once a school term (e.g., two times) between the half year and full year period.

Phone conversations that occurred during the 3-month and 6-month periods for waves 1 and 2 were conducted by the project research officer, and by the author and project dietician between the 6-month and 12-month period. All phone contact for wave 3 was conducted by the author and dietician project team member for metropolitan cohorts, and the physiotherapist and dietician instructors who implemented CAFAP in the regional setting. Discussions were targeted toward adolescents, although calls were occasionally conducted with parents when an adolescent was not available. The research team felt discussions with parents were appropriate in such instances given these families reported using goal setting as a tool to maintain current behaviours. The structure for phone calls included a review of progress in each behaviour area (e.g., physical activity, sedentary behaviour, and healthy eating) and discussion of potential strategies for maintaining and/or increasing these behaviours and overcoming any potential barriers. During each nominated phone call period, calls were placed twice a week to families until the adolescent or his/her parent was available to conduct the support conversation.

SMS messages were delivered using the semi-automated online system, SMS Solutions Australia. Messages were delivered to adolescents' mobile phones, with the exception of instances when adolescents did not own a mobile phone. In the later situation, parents received messages and were asked to show adolescents each message. Delivery of

messages was monitored weekly by the project research officer during the first phase (e.g., April 2012 to November 2012) of the project, and by the author and project dietician in the second phase (e.g., December 2012 to December 2013). Undelivered messages due to a phone being switched off or disconnected were followed-up by the respective project member to confirm if a new number was assigned to the participant's phone or if there were alternative means for reaching the adolescent if a phone was continually switched off or otherwise non-functional (i.e., battery not adequately charged).

During the end of the 3-month follow-up period, adolescents were also provided the option to join a private online social network group on Facebook to share experiences and recipes, gain further exposure to prompting in goal setting and behaviour engagement, and to link in with other CAFAP participants (see Appendix T). A study website (see Appendix U) was also provided with public information including program goals, registration for participation, and tips for health behaviours throughout the duration of the study.

3.8 Instruments

3.8.1 Intervention fidelity – outcome measures related to instructor behaviours (provision of need-support and goal setting environments). Instructor fidelity was assessed to ensure program content was delivered appropriately in line with the current study objectives (Bellg et al., 2004). Prior to delivery of the first program wave, raters were trained by the author on how to assess observations of sessions to measure intervention fidelity. Raters included the author and the project physiotherapist and dietician. All raters attended the instructor training and were aware of the need-supportive behaviours described to instructors. Training in rating therefore only briefly covered need-supportive behaviours described to instructors and addressed what each behaviour listed on the observational checklist would appear as at each end of the scoring range (e.g., score of 1 and score of 7).

Trained raters assessed program instructors' behaviours at two points during each wave. The first assessment point was conducted early in the program and addressed fidelity of content and delivery of need-supportive behaviours. The second assessment was conducted near the end of the program and measured outcomes assessed at the first collection point, as well as instructors' promotion of goal setting behaviours. All disciplines were initially assessed during the fourth program session, and later assessed according to the instructor's session number assigned for leading goal setting content (e.g., psychologist and physiotherapist/exercise physiologist session 9; dietician session 15).

Assessments were conducted using an observational checklist (see Appendix V) completed by raters and a self-report measure completed by instructors (see Appendix W). Autonomy support items for both measures were adapted from McLachlan and Hagger's (2010b) measure of perceived autonomy support, and structure and involvement behaviours were adapted from Reeve et al.'s (2004) behaviour observation checklist. Items measuring contents and motives for goal strivings were formatted in accordance with Reeve et al.'s (2004) behavioural observation checklist by rating the degree to which the delivery of each component supported autonomy through the encouragement of intrinsic goal contents and autonomous motives for goal strivings. Fidelity of content was assessed by indicating the degree to which content delivered by the instructor matched topics addressed in the program manual. The observational checklist included eleven items for autonomy support, six for involvement, eight for structure, two items each to address goal contents and motives for goal strivings, and one item for fidelity of content (e.g., used for broader program objectives). All items were rated using a scale from 1 (*behaviours that thwart need satisfaction*) to 7 (*behaviours that nurture basic needs*), with the exception of

fidelity, which was rated from 1 (*program vastly differs from program content*) to 7 (*program closely matches program content*).

The 15-item self-report measure asked instructors to express the extent to which they exhibited autonomy support, structure, and involvement using a 4-point scale ranging from 1 (*not true at all*) to 4 (*very true*). Example items included: "I provide options for physical activity and healthy eating behaviours" (autonomy support), "I provide challenging tasks for participants" (structure), and "I express affection and care toward participants" (involvement). Six items captured autonomy support, and four and five items were used to assess structure and involvement, respectively.

Measures of fidelity were also completed by adolescents and parents with regard to their perceptions of instructors' delivery of need-supportive behaviours. The context for need-support related to adolescents' perceptions of instructor behaviours to support their physical activity and healthy eating, and parents' perceptions of instructor behaviours to encourage their engagement in behaviours to support adolescents' changes. The two 14-item scales used to measure perceptions related to physical activity (see Appendix X for adolescent measure and Appendix Y for parent measure) and healthy eating (see Appendix Z for adolescent measure and Appendix AA for parent measure) were modified from the Perceived Autonomy Support Scales for Exercise Settings (PASSES; Hagger et al., 2007) and the Perceived Environmental Supportiveness Scale (PESS; Markland & Tobin, 2004a). An example item from the scale is: "I felt the instructor provided me with choices, options, and opportunities to do [behaviour]" with 'physical activity' and 'healthy eating' inserted accordingly for the behaviour referent being assessed. Responses were indicated using 7-point scales ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), and summed to create a mean score. Internal reliability for the PASSES has been reported in reference to

adolescents' perception of their physical education teachers (α=.93) and parents (α=0.96) (Hagger et al., 2007). Internal reliabilities for each subscale in the PESS has been reported in adult samples to be .79 (autonomy support), .79 (structure), .78 (involvement) with regard to perceived daily exercise environment (Markland & Tobin, 2004a).

3.8.2 Outcome measures for adolescents.

3.8.2.1 Self-determination theory outcomes.

3.8.2.1.1 Perceived autonomy support, structure, and involvement. The modified version of the PASSES (Hagger et al., 2007) and PESS (Markland & Tobin, 2004a) used to measure perceptions of instructor need-support was also used to measure adolescents' perceived need-support from parents with regard to adolescents' physical activity (see Appendix BB) and healthy eating behaviours (see Appendix CC). To capture perceptions specific to parent behaviours, the text referring to instructors was amended to reflect parents as the referent. Responses were indicated using 7-point scales ranging from 1 (*strongly disagree*) to 7 (*strongly agr*ee), and summed to create a mean score.

3.8.2.1.2 Autonomous motivation. Autonomous motivation for physical activity behaviours was measured using the revised Behavioural Regulation in Exercise Questionnaire Version 2 (BREQ-2; Markland & Tobin, 2004b) and the Integrated Regulation Scale for Exercise Behaviour (McLachlan, Spray, & Hagger, 2011; see Appendix DD). Adolescents were asked to indicate their feelings about participating in physical activity using a 4-point scale ranging from 1 (*not at all true*) to 4 (*very true*). Sample items for each regulation style included: "I enjoy physical activity sessions" (intrinsic motivation, α = .86), "being physically active is genuinely a part of me" (integrated motivation, α = .92), "I am physically active because I gain a lot of benefits that are important to me" (identified regulation, α = .73), "I feel like a failure if I have not done any physical activity in a while"

(introjected regulation, α = .80), "I feel under pressure from my friends/family/partner to be physically active" (external regulation, α = .79), and "I don't see why I should bother doing any physical activity" (amotivation, α = .86). The 25-item scale has been validated in a sample of obese adolescents (Verloigne et al., 2011) and was comprised of three items used to measure introjected regulations, six items for integrated regulations, and four items each to assess amotivation, intrinsic, extrinsic, and identified regulations.

Autonomous motivation for healthy eating behaviours was measured using an adapted version (see Appendix EE) of Mullan, Markland, and Ingledew's (1997) Behavioural Regulation in Exercise Questionnaire (BREQ) and Ryan and Connell's (1989) Perceived Locus of Causality for Diet (PLOC; Hagger, Chatzisarantis, & Harris, 2006a; Hagger et al., 2006b) and the Integrated Regulation Scale for Exercise Behaviour (McLachlan et al., 2011). Adolescents were presented with a common question: "Why do you eat healthy?" and asked to rate several reasons pertaining to each regulation style: intrinsic motivation (i.e., "because I enjoy eating healthy"), integrated regulation (i.e., "because eating healthy is essential to my identify and sense of self"), identified regulation (i.e., "because I value the benefits of eating healthy"), introjected regulation (i.e., "because I will feel guilty if I do not eat healthy"), external regulation (e.g., "because others want me to eat healthy"), and amotivation (i.e., "I don't see why I should bother eating healthy"). Adolescents responded to the 21-item scale using a 4-point scale ranging from 1 (*not true at all*) to 4 (*very true*). Amotivation, intrinsic, and integrated regulations were measured using four items for each regulation, and three items each were used to measure introjected, extrinsic, and identified regulations. Mean scores for each type of motivation were assigned the following weights and summed (e.g., to allow for variation in items used to measure each type of motivation)

to form a single relative autonomy index (RAI) for physical activity and healthy eating: intrinsic +3; integrated +2; identified +1; introjected -1; external -2; amotivation -3.

3.8.2.2 Psychological outcomes.

3.8.2.2.1 Quality of life. Quality of life was measured using the Paediatric Quality of Life – Teen Report (PedsQL; Varni, Seid, & Kurtin, 2001; see Appendix FF). The PedsQL is a 23-item self-report measure for 13-18 year olds and consists of Generic Core Scales (Physical Functioning, Emotional Functioning, Social Functioning, and School Functioning) that are used to derive measures of psychosocial, physical, and health-related qualities of life.

Adolescents were asked in the instructions to indicate how much of a problem each item had been in the past month using a 5-point scale ranging from 0 (*never a problem*) to 4 (*almost always a problem*). The raw scores were then transformed by assigning the following scores: 0 = 100; 1 = 75; 2 = 50; 3 = 25; 4 = 0, with higher scores indicating greater quality of life. Scale scores were then computed by averaging the transformed scores. Psychosocial health scores were computed using the mean of items answered in the Emotional (5 items), Social (5 items), and School Functioning (5 items) Scales. Scores for physical health were computed using the mean of items on the Physical Functioning Scale (8 items). Health-related quality of life was assessed using scores across all Generic Core Scales. The measure has been shown to have good reliability ($\alpha = 0.88$) and internal consistency (Varni, Limbers, Newman, & Seid, 2008; Varni et al., 2001).

3.8.2.2.2 Depressive symptoms. The Short Moods and Feelings Questionnaire (SMFQ; Costello & Angold, 1988) was used to assess adolescents' depressive symptoms (see Appendix GG). The 13-item scale is derived from a 34-item depression questionnaire (Moods and Feelings Questionnaire; Costello, Benjamin, Angold, & Silver, 1991) and assesses the frequency of moods experienced in the preceding two weeks using a 3-point

scale ranging from 0 (*not true*) to 2 (*true*). Although cut-offs may be applied to indicate the possible presence of a depressive disorder, for purposes of the current study summed scores were used to indicate degree of change in the frequency of depressive symptoms, with greater scores indicating higher frequencies of depressive symptoms. The SMFQ has high internal consistency (alpha = 0.94; A. Wood, Kroll, Moore, & Harrington, 1995) and has been validated in a clinical and non-clinical sample (Burleson Daviss et al., 2006).

3.8.2.3 Goal setting theory outcomes.

3.8.2.3.1 Goal attainment. Weekly goal sheets and the overall matrix (Appendix R) provided during the program and 3-month post-program period included a space for recording goal progress at the end of each week and at the end of each data collection period (e.g., post-program and 3 months) using a scale ranging from 1 (*did not meet goal*) to 10 (*fully met goal*). Recording both weekly and overall progress allowed adolescents to evaluate their status and adjust goals accordingly, while also providing a measure of their goal attainment (Sheldon & Kasser, 1998). Due to limited completion of weekly goal setting booklets following the intensive program, weekly scores could not be summed to derive a relative index of goal attainment over the follow-up periods as initially planned. In combination with these limitations, and to reduce participant burden across data collections, overall scores recorded for goal progress was instead used to measure goal attainment at the respective data collections. The overall attainment score included a single rating assigned for each behaviour in the overall goal setting matrix. Individual scores were aligned with specific behaviour outcomes (e.g., goal progress for steps corresponded with the behaviour outcome for light physical activity), with the exception of goal progress scores for fruit and vegetables, which were summed to reflect goal attainment for healthy food intake (combined fruit and vegetable serves) and goal progress scores summed for light

(e.g., steps) and moderate-to-vigorous physical activity summed to reflect goal attainment for total physical activity. Attainment scores related to sedentary behaviour were not included in the current study, and were only assessed to evaluate outcomes for the broader study.

3.8.2.4 Physical activity. Adolescents were provided with the widely validated and commonly used (Colley & Tremblay, 2011; Puyau, Adolph, Vohra, Zakeri, & Butte, 2004) Actical monitors (Respironics; Bend, Oregon, USA) to measure amount of time spent in light and moderate-to-vigorous intensity physical activity over seven consecutive days during the school term. Seven days of measurement are recommended for adolescents (Trost, McIver, & Pate, 2005). Accelerometers were provided on an elastic band, and adolescents asked to wear the accelerometer on their right hip (see Appendix HH). Adolescents were informed of the water-proof properties of the accelerometer and encouraged to wear the accelerometer during daily activities and while sleeping. A project staff member trained in accelerometry performed analyses using the ActiCal software LabView V7® (National Instruments, Austin, TX, USA). Intensity levels were divided into categories for light, moderate-to-vigorous, and total (e.g., light and moderate-to-vigorous) physical activity. Mean daily minutes of activity at each intensity were calculated, with analyses adjusting for total wear time.

Physical activity was also measured using a self-report of behaviour frequency over the past 7-days (see Appendix II). Physical activity behaviours were assessed using questions drawn from the Western Australian Child and Adolescent Physical Activity and Nutrition Survey and the Healthy Kids Queensland Survey (Abbott et al., 2008; Hands, Parker, Glasson, Brinkman, & Read, 2004). Reported physical activity behaviours included sports, active play (i.e., playground and mucking around), getting around (i.e., walking, cycling, and skating), and active chores (i.e., tidying your room, gardening). Frequency was indicated on a 5-point

scale ranging from 1 (*not at all*) to 5 (*6-7 x week*). Responses were summed and a mean score calculated to form a single score for physical activity frequency.

3.8.2.5 Food intake. Adolescents were asked to record their eating behaviour in a 3-day food diary (Appendix JJ) during the week corresponding with accelerometer assessment of physical activity. Food intake included all food and drink items consumed over a consecutive 3-day period, including two weekdays and one weekend day. Written instructions for recording portion sizes were provided at the front of each food diary and verbal instructions reiterating these points were provided at entry, pre-program, and immediate post-program assessments. All families were provided a set of measuring cups to assist in recording accurate portion sizes.

Given there is currently no consensus in the literature in support of the most effective measure of food intake among overweight and obese adolescents (Livingstone & Black, 2003; Livingstone & Robson, 2000; Magarey et al., 2011), a 3-day diary was chosen as the most appropriate method for capturing detailed meal and snack patterns necessary to inform behaviour change outcomes (Livingstone & Robson, 2000) while limiting the burden of reporting.

Analyses were conducted by the project dietician using the AUSNUT database and Foodworks Professional Edition version 3.02 software (Xyris Software Pty Ltd, Brisbane, Australia). Number of fruit and vegetable serves was determined in accordance with guidelines described in the Australian Guide to Healthy Eating (A. Smith, Kellett, & Schmerlaib, 1998), and averaged over the 3-day period to create a single score for each food type. Average scores for fruit and vegetable serves were summed to create a single index of healthy food intake. Junk food portions were identified in line with the Food Criteria System created by Rangan et al. (2008) and classified into 600 kJ servings as per the guidelines

outlined in the Australian Guide to Health Eating (A. Smith et al., 1998). The number of junk food serves across the three days was averaged to create a single score for intake of unhealthy food.

3.8.2.6 Biomedical outcomes. Body weight and height were measured to obtain a description of anthropomorphic characteristics of the sample population. Body weight was measured in kilograms (kg) using an electronic calibrated scale. Due to limitations placed on measuring height in the community (e.g., stadiometer), height was assessed by marking participants' height against a wall and using a tape measure to assess the distance. BMI was calculated using the Center for Disease Control and Prevention (CDC) Growth Charts (2002) and then standardized to appropriate age and sex BMI z-scores to provide a more accurate measure of weight status (Bell et al., 2007; Watts, Bell, Byrne, Jones, & Davis, 2008).

3.8.3 Outcome measures for parents.

3.8.3.1 Self-determination theory outcomes.

3.8.3.1.1 Autonomous motivation. The Behavioural Regulation in Exercise Questionnaire Version 2 (BREQ-2) (Markland & Tobin, 2004b) and the Integrated Regulation Scale for Exercise (McLachlan et al., 2011) described in relation to adolescent outcomes were modified to measure parents' degree of autonomous motivation for supporting adolescents' physical activity (see Appendix KK). Parents were asked to respond to the 25-item scale by indicating their motivations using a 4-point scale ranging from 1 (*not at all true*) to 4 (*very true*).

Autonomous motivation to engage in behaviours to support adolescents' healthy eating choices was assessed using an adapted version of the PLOC (Hagger et al., 2006a, 2006b) and Integrated Regulation Scale for Exercise Behaviour (McLachlan et al., 2011) used to measure adolescents' autonomous motivation (see Appendix LL). The questionnaire

presented parents with a common stem: “Why do you support your adolescent’s healthy eating?” and then asked parents to rate several reasons pertaining to each regulation style. Motivations were assessed on the 21-item measure using a 4-point scale ranging from 1 (*not true at all*) to 4 (*very true*).

3.8.3.1.2 Provision of autonomy support, structure, and involvement. The adapted version of McLachlan and Hagger’s (2010b) self-report measure and Reeve et al.’s (2004) checklist previously described for instructors was adapted to measure parents’ perceptions of their need-supportive behaviour demonstrations (Appendix MM). Parents were asked to express the extent to which they felt they demonstrated an environment with autonomy support, structure, and involvement for their adolescents. Parents responded to the 15-item self-report measure using a 4-point scale ranging from 1 (*not true at all*) to 4 (*very true*). Autonomy support was captured using six items, structure using five items, and four items were used to assess involvement.

3.8.3.2 Goal setting theory outcomes.

3.8.3.2.1 Goal attainment. Parents were provided goal setting booklets aligned with the format presented to adolescents. In line with procedures used to assess adolescent goal attainment, parents were asked to record progress made on their overall and weekly goals (see Appendix S). Parents also preferred not to complete weekly goal progress scores following the intensive program and consequently weekly scores could not be summed to compute a relative index of goal attainment during the follow-up periods. Participant burden was therefore reduced by choosing to only draw goal attainment scores from overall progress ratings. Parents were asked to report progress made on their goals to support goals set by adolescents using a scale from 1 (*did not support goal*) to 10 (*fully supported goal*). Goal attainment for each behaviour was represented by the single scale score

reported for the behaviour at the respective data collection. Individual goal progress scores were aligned with specific behaviour outcomes for adolescents (e.g., goal progress for supporting adolescent goals for steps corresponded with the behaviour outcome for adolescent light physical activity), with the exception of goal progress scores for supporting adolescent fruit and vegetable serves, which were summed to reflect goal attainment for supporting adolescent healthy food intake (combined fruit and vegetable serves) and goal progress scores summed for supporting adolescent light (e.g., steps) and moderate-to-vigorous physical activity summed to reflect goal attainment for supporting adolescent total physical activity. Scores for sedentary behaviour were excluded from the current study, and were only used to accommodate outcomes of the broader study.

3.9 Data Collection

3.9.1 Administration of adolescent and parent assessments. Entry and pre-program data was collected at program sites during the last week of school holidays preceding the start of the school term allocated for waitlist periods and intensive program starts, respectively. Participants unable to attend program sites on dates allocated were assessed at a preferred time and location nominated by the participant's family. Follow-up data collections were conducted over a 5-week period (e.g., afterschool and during school holidays) in a combination of locations including Curtin University, program sites, and participants' homes as needed to encourage completion of assessments.

Prior to entry and pre-program assessments participants were contacted by the research team (e.g., the author, project dietician, and project research officer) 3-weeks prior to the data collection period to arrange a preferred time to attend during each assessment period. Post-program assessments were scheduled in-person by research team members at the conclusion of the last program session. Multiple contacts with families via phone calls,

SMS, post mail, and email were used to encourage attendance at assessments. Post-program follow-up assessments (e.g., 3, 6, and 12 months) were typically promoted as "catch-up" sessions, which provided the opportunity to complete assessments while also socialising with other participants. The session was held on a single day at each program site and included activities for adolescents with the physiotherapist/exercise physiologist, healthy snacks, and discussions amongst parents while assessments were completed with adolescents. Instances when a minimum of at least three participants were not able to concurrently attend, individual appointments were made for all participants from the respective cohort. Any participants who did not respond prior to the data collection period were continually contacted during the 5-week assessment period to arrange for attendance at a later date. Participants who did not respond during the 5-week period or who actively chose to decline an assessment were classified as dropping out of the study.

Assessments in metropolitan settings were conducted by CAFAP team members including the author, project dietician, and project research officer. Regional location assessments were conducted by the project dietician in conjunction with all regional instructors prior to program delivery and later conducted at all post-program periods by the dietician and physiotherapist instructors responsible for delivering the regional CAFAP. Assessors recorded anthropomorphic measurements (height and weight) and conducted additional tests as part of the broader study (see Straker et al., 2012). Accelerometers and food diaries were also distributed at entry and pre-program at the assessment session and posted back by participants using Express Paid parcels. Questionnaires were completed during the face-to-face assessments at entry and pre-program. Accelerometers, food diaries, and questionnaires for the immediate post-program assessment were distributed at the last CAFAP session and returned the following week at the participant's scheduled

assessment. Accelerometers, food diaries, and questionnaires were distributed for the post-program follow-up periods in the week prior to the "catch-up" session, and participants asked to bring their respective items when attending the session.

Questionnaires at each data collection were paper-based and assessed adolescent autonomous motivation, perceived parent support, quality of life, depressive symptoms, physical activity behaviours; and parent autonomous motivation to support adolescent healthy lifestyle choices and provision of need-supportive behaviours. All post-program data collections also included assessment of overall goal attainment for adolescents and parents. In addition, assessments immediately following completion of the intervention (e.g., post-program) also assessed adolescent and parent perceptions of instructors' need-supportive behaviours.

Minimal reporting of food intake was provided by adolescents at the wave 1 entry assessment, which led to the introduction of gift vouchers offered at all subsequent data collections. Amounts offered were either $5 or $10 depending on the degree of diligence used to complete each food diary. For example, listing just a general description of food serves (e.g., salad) was awarded $5; whereas, listing detailed contents of food serves (e.g., half a tomato, one cup of lettuce, and one fourth cup of carrots) was awarded $10. Gift vouchers were presented immediately preceding the next data collection (e.g., awarded immediately prior to 6 month data collection for diary completed at the 3 month data collection). Vouchers corresponding with food diaries completed for the 12 month assessment were posted to participants.

Although the use of monetary incentives may appear contrary to study objectives by promoting external motivations, it is suggested within the self-determination theory literature that not all regulations are intrinsic, and may require external regulations to occur

at all (Grolnick et al., 1997). The endorsement of external regulations is particularly common with regard to healthy lifestyle behaviours that are perceived to be required by social agents (Power et al., 2011), although not necessarily desired by the individual. Adolescents who are overweight and obese are frequently cited as underreporting food intake (Livingstone, Robson, & Wallace, 2004), which is likely associated with external regulations. Whilst every attempt was made during the intervention to foster intrinsic motivation, data collected prior to the intervention was reliant on accommodating current states of regulation (i.e., external) to obtain accurate reports of food intake to effectively inform study objectives. With regard to incentives during the post-program period, the project team felt that rewards were likely to be perceived as an accompaniment to behaviour change strategies promoted in the program, such that rewards served more of an informational purpose (Hagger et al., 2013), rather than controlling, when limited solely to intake reported in the food diary.

3.9.2 Administration of instructor assessments. During the instructor training, all instructors were made aware that two of their sessions would be observed and self-report measures completed for the corresponding session. Rater-observations were completed using a combination of face-to-face attendance and audio recorded sessions. All wave 1 sessions were conducted face-to-face, as the research team felt adolescent participants were likely to drop out of the study if asked to consent to audio recordings of program sessions. In wave 2, the perceived fear of participant drop-out was lessened and consent was sought for audio recordings. However, segments of the first observation were still conducted face-to-face as well as audio recorded given the changeover to new instructors. All sessions were audio recorded in wave 3 given multiple sessions had been observed for instructors at metropolitan locations and fears had fully subsided with regard to participant

drop-out associated with audio recordings. Both regional assessments were audio recorded due to travel restraints imposed by distance to attend individual sessions. Face-to-face observations conducted during wave 1 and wave 2 were completed by the author along with the project physiotherapist and dietician. Rater-observations of all audio recorded sessions for wave 2 and wave 3 were completed by the author.

Instructors were asked to complete the self-report measure immediately following each assessment. Observations of face-to-face sessions conducted by the author were discussed with instructors immediately following completion of the program session and self-report measure to provide in vivo feedback on instructors' use of behaviours. Two sessions were observed face-to-face without the author present, due to the author's coinciding presence at observations located at the alternative program site. In these instances, the author discussed observations with the rater in attendance, and provided feedback to instructors within the week following observation. Feedback regarding audio recorded sessions was provided via telephone by the author in the week following recording to allow time for audio recorders to be returned, content downloaded, and observations undertaken.

3.10 Summary

This chapter has provided a description of the research design and methods implemented for the current study:

- The study sample was comprised of overweight and obese adolescents (aged 11 to 16 years) with a BMI greater than the 85th percentile, and their parents. Participants lived near program sites conducted in community settings located in the east and south metropolitan suburbs of Perth, Western Australia and a south western regional location in Western Australia.

- A number of recruitment strategies were engaged to attract participants to the program. These strategies included contacting potential participants through local schools and professionals in the health system, as well as distributing mass media messages.
- Intervention components written for the current study formed part of a broader 16 session multi-disciplinary program, CAFAP. Components of the current study included training program instructors across multiple disciplines (e.g., psychologists, physiotherapists/exercise physiologists, and dieticians) in need-supportive behaviour methods for delivering all CAFAP sessions and goal setting strategies delivered on a weekly basis based on the integration of self-determination theory and goal setting theory. All components of the broader study were edited by the author to ensure concepts complied with theoretical underpinnings. In addition, instructors delivered content specific to the current study in four parent sessions and three adolescent sessions, with these themes also carried throughout additional program components.
- Program outcomes were assessed using questionnaires, food diaries, and accelerometers. Fidelity was ensured through session observations and questionnaires.

Chapter 4

Results

4.1 Introduction

The following chapter presents results from the Curtin University's Activity, Food, and Attitudes Program (CAFAP) based on the integration of self-determination theory (Deci and Ryan, 2000) and goal setting theory (Locke & Latham, 1990). Findings are first presented with respect to the participant sample, recruitment, entry characteristics, attrition, participant flow, and response rates across data collection periods. Analyses are then discussed in relation to intervention fidelity, direct effects of the intervention, and mechanisms underlying change following intervention.

4.2 Sample

A total of 123 adolescents and their parents expressed an interest in participating and contacted the research team to gather further information. Based on parent reports of adolescents' weight and height, 122 adolescents met the inclusion criteria of a BMI in excess of the 85th percentile and were asked to seek approval from their general practitioner to participate. Of these, 48 chose not to participate due to reasons including: commitments that conflicted with session times, adolescent fear of being judged by program facilitators, adolescent disinterest in attending, adolescent not interested in losing weight, and others did not provide a reason for choosing not to enrol in CAFAP. In total, 75 adolescents and their parents agreed to participate and 68 completed entry assessments. Adolescents who completed entry assessments consisted of 49 females and 19 males with mean age 14.06 ± 1.59 years (range 11.25–16.92) and a mean BMI z-score 2.10 ± .40 (range .87–2.91). Characteristics of adolescent participants at entry are outlined in Table 7.

4.3 Flow of Participants

Following completion of entry assessments, participants completed pre-program assessments after waitlisting for one school term (3 months). During the waitlist period, 11

(16%) participants dropped out of the study (see Table 8 and participant flow chart in Figure 3). Reasons for drop out during the waitlist period included adolescent disinterest and not enough time to attend sessions. In total, 57 (83%) participants completed both entry and pre-program assessments and began attending CAFAP sessions.

During the intensive intervention phase, 14 participants (inclusive of one participant who only completed a pre-program assessment) dropped out of the program. Reasons for drop out included: adolescent disinterest, difficultly attending session times, and others did not specify. In total, 44 (64%) participants completed the intensive program and corresponding post-program assessment.

The 3-month follow-up assessment was attended by 40 (58%) participants and at 6-month follow-up 37 (54%) participants attended. The final data collection at 12-month follow-up was attended by 34 (50%) participants. Overall, 34 participants completed the intensive program and attended all six assessment periods from the 68 participants who completed entry assessments.

4.3.1 Selective attrition. Selective attrition was examined by comparing participants who remained in the study for all follow-up points to those who were lost at pre-program, post-program, and follow-up assessments. Participants who dropped out at follow-up assessments at 3, 6, and 12 months post-program were aggregated into a single group given the limited numbers at each assessment period. The only categorical variable, adolescent gender, was examined using Fisher's Exact Test. A univariate analysis of variance (ANOVA) was used to determine whether the means differed for the remaining adolescent variables assumed to be continuous including: age, BMI z-score, junk food serves, fruit and vegetable serves, physical activity (self-reported and accelerometer-based), health-related quality of life, depressive symptoms, perceived parent support, and autonomous motivation for

physical activity and healthy eating. Parent variables were also examined for autonomous motivation to support adolescent physical activity and healthy eating as well as demonstration of need-supportive behaviours.

Adolescents (Table 9) who were lost at pre-program, immediate post-program, and remaining post-program follow-up assessments appeared to be no different at entry than those who remained enrolled for the duration of the study in respect to the following variables: gender (p = .240); age (F (3, 64) = 1.92, p = .135); BMI z-score (F (3, 64) = .770, p = .515); junk food serves (F (3, 54) = 7.37, p = .535); fruit and vegetable serves (F (3, 54) = 1.73, p = .172); self-reported physical activity (F (3, 61) = .537, p = .659); accelerometer-based light physical activity (F (3, 58) = 2.18, p = .101); accelerometer-based moderate-to-vigorous physical activity (F (3, 58) = .92, p = .435); accelerometer-based total physical activity (F (3, 58) = 1.26, p = .298); autonomous motivation for physical activity (F (3, 60) = .397, p = .756) and healthy eating (F (3, 59) = .069, p = .976); perceived parent support for healthy eating (F (3, 60) = .264, p = .851) and physical activity (F (3, 60) = .899, p = .447); health-related quality of life (F (3, 61) = .784, p = .507); and depressive symptoms (F (3, 61) = .861, p = 467). Comparisons of entry scores among parents of adolescents across the different phases of retention revealed no differences in autonomous motivation to support adolescent physical activity (F (3, 60) = .406, p = .749) and healthy eating (F (3, 60) = .334, p = .800; see Table 10). Although significant differences were demonstrated in the provision of need-supportive behaviours (F (3, 60) = 2.82, p = .046).

4.3.2 Attendance. Attendance was recorded by instructors at each program session. Adolescents and their parents were only included in the analyses when attendance was recorded for a minimum of 12 sessions (e.g., 75%) during the 8-week period and the parent received initial training in need-supportive behaviours. Of the participants with complete

data across all time points, no participants were excluded from analyses due to not meeting the minimum attendance requirements for the program duration.

4.3.3 Longitudinal data. In order to assess changes across time points, participants were only included in a set of analyses when the respective variables were completed at all data collection periods. This meant a participant who failed to complete a measure at a minimum of one time point was excluded from any analyses in which this variable was assessed.

4.4 Missing Data and Recording Errors

Table 11 indicates response rates from participants who remained in the study during the 12-month follow-up period. Response rates at each data collection period reflect the number of participants who completed the respective assessment at the specified point in time. The total sample reported in the table reflects participants with data at all collection periods and thus represents the total number of participants used in determining effects of the intervention and the number of participants with data for consideration in the respective mediation analyses. Missing data for each variable is described below from the sample of participants enrolled for the duration of the 12-month follow-up period. Results described in the remainder of the current chapter that refer to adolescent and parent outcomes following intervention include only the sample of participants with a complete data set across all six data collection periods for the variable(s) included in the respective analysis. Results of intervention fidelity were assessed using all available data from instructors, participants, and external rater observations. A detailed review of missing data and recording errors is provided in Appendix NN.

4.5 Waitlist Period

Effects of the intervention were assessed using the sample of participants that completed waitlist assessments (e.g. entry and pre-program), the intensive 8-week program, and all post-program assessments during the 12-month follow-up period. The waitlist period was used to provide a within-participants control. Differences in outcomes at entry and pre-program were examined prior to investigating intervention effects to ensure the waitlist period could serve as a within-participants control. Adolescent variables included: autonomous motivation for physical activity, autonomous motivation for healthy eating, perceived parent support for physical activity, perceived parent support for healthy eating, quality of life (physical, psychosocial, and health), depressive symptoms, physical activity (self-reported and accelerometer-based), junk food serves, and fruit and vegetable serves, and BMI z-scores. Parent variables included: autonomous motivation to support adolescent healthy eating, autonomous motivation to support adolescent physical activity, and provision of need-supportive behaviours. Results of the paired samples *t*-test found significant differences during the waitlist period in adolescent junk food serves ($p = .04$) and parent autonomous motivation to support adolescent physical activity ($p = .04$). All remaining variables were not significantly different during the waitlist period (see Table 13).

4.6 Testing Assumptions

Prior to assessing study objectives data was analysed to identify significant univariate outliers ($p < .05$) and bivariate correlations were also examined where necessary to test for multicollinearity among variables (correlation matrices are presented in Appendix OO for each data collection period).

4.6.2 Intervention fidelity. Two adolescents reported significantly lower scores with regard to perceived instructor support for physical activity (waves 1 and 3, east

metropolitan). Evaluation of instructor support for healthy eating was also rated significantly lower by one parent (wave 1, south metropolitan). Comparison of means revealed no significant differences when outliers were excluded or included. Outliers therefore remained unchanged in the data set.

Univariate analyses of instructors' overall self-report of behaviours and multivariate reports across time points revealed no significant outliers. Rater-observations of instructors revealed significantly lower scores for need-supportive behaviours demonstrated by the regional psychologist. These scores were believed to be a true and accurate reflection of the instructor's behaviours based on a sequence of events that continued to take place throughout the instructor's delivery of program content. Instances included: reports from the co-instructors (physiotherapist and dietician) of concern that the psychologist was not delivering content; observation recordings capturing the psychologist reporting to participants that she had not read the program content and asking participants about when certain items were meant to take place that she was designated to lead; denial during booster sessions of failing to deliver content; confessing to not pre-reading manual and not adhering to manual or engaging in need-supportive behaviours based on content presented in recorded observations. Although the research team was made aware of these issues after the fourth program session, it was not feasible to recruit a replacement psychologist given the difficulty of finding health professionals in regional settings and the limited turn-around time required. Attempts were made by the research team to improve delivery of intervention components by re-assigning goal setting content to the physiotherapist and dietician, as well as emphasizing to the psychologist instructor the importance of reading the manual prior to session delivery and promoting need-supportive environments by delivering behaviours as outlined on the observation measure and in training content. Mean

scores of rater observations for the regional psychologist remained unchanged in order to maintain a measure of instructor fidelity from an external observer.

4.6.1 Adolescent and parent variables. Univariate outliers in the adolescent data set included physical-related quality of life at pre-program for one adolescent, health-related quality of life assessed at post-program and 3 months (same participant in both instances), and the combined score for fruit and vegetable intake for a single participant at post-program and 3 months. Mahalanobis distance also exceeded the critical value χ^2 for df = 2 (at $\alpha = .001$) of 13.82 in two cases for a single adolescent participant. Both cases referred to differences from post-program to 3 months and indicated a significant reduction in perceptions of parental support for physical activity and healthy eating. No univariate or multivariate outliers were identified in the parent data set. Analyses run with the inclusion and exclusion of the respective outliers revealed no significant differences, as a result outliers remained unchanged in the dataset.

4.7 Objective 1: Intervention Fidelity

Intervention fidelity was assessed to ensure CAFAP was delivered in line with the theoretical underpinnings, that is, in a need-supportive context alongside the promotion of intrinsic goal contents and autonomous motives for goal strivings. Mean scores for instructor self-report of need-supportive behaviour demonstration is presented in Table 14 for each assessment across the three program waves. Inter-rater reliability between rater-observations was assessed using Cohen's linear weighted Kappa (κ_w) and the prevalence and bias-adjusted Kappa (PABAK). Agreement ratings between rater 1 (author) and rater 2 (project dietician) were comprised of observations recorded in wave 1, session 3 (east metropolitan psychologist) and wave 2, session 4 (east metropolitan psychologist and physiotherapist). Agreement ratings between rater 1 and rater 3 (physiotherapist project

member) were established based on observations from wave 2, session 9 (south metropolitan psychologist and exercise physiologist) and wave 2, session 15 (south metropolitan dietician). Percentage agreement between rater 1 and rater 2 was found to be 93%, with a $\kappa_w = 0.65$ (95% confidence interval = 0.43 – 0.87) and a PABAK of 0.93, indicating almost perfect reliability.[4] Percentage agreement between rater 1 and rater 3 was found to be 80%, with a $\kappa_w = 0.40$ (95% confidence interval = 0.25 – 0.54), and a PABAK of 0.81, indicating almost perfect reliability. Based on these findings, in instances when multiple rater assessment could not be obtained, ratings obtained from a single rater's observations were assumed to be a reliable assessment of instructor fidelity. Rater-observation scores for autonomy support, structure, and involvement were summed to derive an overall mean score for need-support and are presented in Table 15. Mean scores were derived from all possible rater-observations, such that dual rater-observations included scores from both raters, and observations by a single rater included only the individual rater's scores. Rater-observations of instructor promotion of intrinsic goal contents and autonomous motives for goal strivings were independently summed for the promotion of each type of reason associated with goal striving and mean scores reported in Table 16. Mean scores for adolescents' and parents' perceptions of instructor need-supportive behaviours demonstrated in relation to healthy eating and physical activity are shown in Table 17 and Table 18, respectively.

4.8 Objective 2: Effects of the Intervention

A series of one-way (within-participants) repeated measures analysis of variance (ANOVA) were conducted to determine effects of the intervention on adolescent healthy lifestyle behaviours, quality of life (psychosocial, physical, and health), depressive symptoms, and self-determination theory outcomes related to adolescents and parents.

Change scores from entry (e.g., entry – pre; entry – post; entry – 3 months; entry – 6 months; entry – 12 months) were used to allow the waitlist period to serve as a control. Pairwise comparisons were carried out when results of the ANOVA were significant ($p < .05$). Post-hoc tests were carried out using a Bonferroni-corrected α of .01 ($p < .05$) and .002 ($p < .01$) to adjust for multiple comparisons for outcomes up to 12-month follow up, and an α of .0125 ($p < .05$) and .0025 ($p < .01$) for accelerometer-based outcomes up to 6-month follow-up.

4.7.2.1 Adolescent self-determination theory outcomes. Differences were shown in autonomous motivation for physical activity, F (4, 120) = 3.39, $p < .05$, partial $\eta^2 = .10$, autonomous motivation for healthy eating, F (4, 120) = 3.42, $p < .05$, partial $\eta^2 = .10$, perceived parent support for physical activity, F (4, 120) = 4.97, $p < .05$, partial $\eta^2 = .14$, and perceived parent support for healthy eating, F (4, 120) = 2.55, $p < .05$, partial $\eta^2 = .08$, following intervention (see Table 19). Pairwise comparisons revealed adolescent autonomous motivation for physical activity was significantly different at 6 months (M = 7.88, SD = 5.08), and 12 months (M = 8.17, SD = 5.07), in comparison to levels of autonomous motivation prior to intervention. Adolescent autonomous motivation for healthy eating remained significantly different across post-program (M = 5.54, SD = 4.79), 3 months (M = 5.70, SD = 4.90), 6 months (M = 5.13, SD = 4.96), and 12 months (M = 5.15, SD = 4.74) compared to autonomous motivation for healthy eating prior to intervention. Perceived parent support for physical activity prior to intervention was shown to be significantly different to perceptions at post-program (M = 5.80, SD = 1.21), 3 months (M = 5.57, SD = 1.34), and 6 months (M = 5.66, SD = 1.08). Perceived parental support for healthy eating was also significantly different at post-program (M = 6.00, SD = 1.09) compared to perceptions of support before intervention (M = 5.51, SD = 1.26).

4.7.2.2 Adolescent psychological outcomes. Differences were shown following intervention in physical-related quality of life, F (4, 124) = 5.19, p < .001, partial η^2 = .14, psychosocial-related quality of life, F (4, 124) = 3.88, p < .01, partial η^2 = .11, and health-related quality of life, F (4, 124) = 6.34, p < .001, partial η^2 = .17 (see Table 20). No significant differences were indicated for depressive symptoms following intervention, F (4, 124) = 1.41, p = .235, partial η^2 = .043 (see Table 20).

Pairwise comparisons further revealed that physical-related quality of life following intervention was significantly greater than pre-intervention levels. Changes reported at 3 months (M = 79.20, SD = 14.19) remained elevated at 6 months (M = 83.30, SD = 11.76), but changes from pre-intervention were not sustained at 12 months (M = 77.25, SD = 18.35). Changes in psychosocial-related quality of life following intervention were also shown at 6 months (M = 76.41, SD = 22.26), but were not maintained at 12 months (M = 72.63, SD = 20.60). In addition, changes in health-related quality of life were shown to be elevated at post-program, (M = 74.98, SD = 16.24), 3 months (M = 76.46, SD = 18.50), 6 months (M = 78.80, SD = 17.09) in comparison to levels reported prior to intervention.

4.7.2.3 Adolescent healthy lifestyle behaviours. No significant differences were demonstrated in post-intervention frequencies of self-reported physical activity F (4, 124) = 1.93, p = .110, partial η^2 = .06 or accelerometer light, F (2.13, 40.5) = 1.13, p = .343, partial η^2 = .06, moderate-to-vigorous, F (1.9, 35.8) = .494, p = .603, partial η^2 = .025, and total physical activity, F (2.3, 43.3) = 1.11, p = .345, partial η^2 = .06 (see Table 21). Significant differences were found for junk food serves following intervention F (2.6, 54.5) = 5.09, p = .003, partial η^2 = .195, although no differences were found in serves of fruit and vegetables F (4, 84) = 2.13, p = .084, partial η^2 = 09. Pairwise comparisons of junk food intake showed serves were

significantly reduced at post-program (*M* = 2.59, *SD* =2.22), 3 months (*M* = 3.05, *SD* = 1.82), 6 months (*M* = 2.66, *SD* = 2.00), and 12 months (*M* = 3.05, *SD* = 2.17).

4.7.2.4 Parent self-determination theory outcomes. No significant differences were shown in parent autonomous motivation to support adolescent physical activity, *F* (4, 116) = 3.52, *p* < .01, partial η^2 = .11, and parent demonstration of need-supportive behaviours, *F* (4, 116) = 4.36, *p* < .05, partial η^2 = .131, although parent autonomous motivation to support adolescent healthy eating, *F* (4, 116) = 2.00, *p* = .091, partial η^2 = .07, was not significantly different following intervention (see Table 22). Pairwise comparisons further demonstrated significant changes in parent autonomous motivation to support adolescent physical activity (*M* = 11.27, *SD* = 2.99) and parent demonstration of need-supportive behaviours (*M* = 3.26, *SD* = .39) were shown at post-program, although these changes were no longer significant at remaining follow-up periods.

4.9 Objective 3: Analysis of Mechanisms

Assessment of mechanisms underlying change following intervention was limited to only those variables considered in objectives 3.1 to 3.6. Mechanisms stipulated in objectives 3.7 to 3.10 (see Appendix PP) were not analysed due to the limited response rates obtained for measures of goal attainment[5].

Partial Least Squares (PLS) path analysis was conducted using the SmartPLS 2.0 software (Ringle, Wende, & Will, 2006) to test mechanisms proposed in objectives 3.1 to 3.6. Variance based PLS path analysis is a distribution-free method and enables researchers to test hypothesized relationships among constructs without adhering to the restrictive assumptions regarding sample size and normality distributions that underlie traditional co-variance structural equation modelling (SEM) techniques such as LISREL. In contrast, PLS allows relationships among multiple independent and dependent constructs to be modelled

when variables involved have departures from normality or are derived from small sample sizes (Chin, 1998)[6].

PLS also departs fundamentally from covariance-based SEM in methods used to estimate parameters by attempting to minimize residual variance rather than minimizing residual co-variance. In other words, PLS seeks to maximize the explained variance (R^2) by maximizing the variance of endogenous variables explained by the exogenous variables, in contrast to reproducing the empirical covariance matrix, which is undertaken in covariance-based SEM. With regard to analysis used in the current study, a particularly desirable feature of PLS is the accommodation of data derived from a small sample size. Whereas covariance-based SEM requires a minimum of 200 cases (Hoelter, 1983), the recommended sample size in PLS is equal to the larger of (a) ten times the number of formative indicators used to measure the largest construct or (b) ten times the number of antecedent constructs used to measure a particular latent construct (Hair, Ringle, & Sarstedt, 2011).

The proposed models in the current study employed a maximum of two paths, amounting to a minimum sample size of 20. With the exception of accelerometer-based physical activity, based on 19 cases in adolescent models and 17 cases in parent models, a minimum of 20 cases were considered for individual variables in the current data set, thus data exceeded sample requirements for PLS, but fell short of adhering to the more stringent requirements for covariance-based SEM. Although cases used in analyses including accelerometer-based physical activity fell just short of the minimum requirement, it was felt that findings would still make a contribution to the literature given the benefits of using objective measures of physical activity (Corder, Ekelund, Steele, Wareham, & Brage, 2008; Slootmaker, Schuit, Chinapaw, Seidell, & van Mechelen, 2009).

4.9.1 Testing proposed models – Adolescent models. All models used to explore the mechanisms in the proposed hypotheses consisted of a single independent variable, mediator variable, and dependent variable (see Figure 4). Mediation was tested using the bootstrapping procedures in SmartPLS to examine the pathways between variables in each proposed model. Bootstrapping procedures estimate the sampling distribution of a statistic by treating the observed data as if it represents the entire statistical population being examined. The procedure creates the number of pre-specified bootstrap samples by randomly drawing cases from the replacement data available in the original sample (Henseler, Ringle, & Sinkovics, 2009). Bootstrapping samples were set to 5,000 (Hair et al., 2011) for analysis of all proposed models in the current study, which meant the replication procedure occurred 5,000 times in order to obtain t-values of the path coefficients. Critical values for a two-tailed test at .05 and .01 significance levels were 1.96 and 2.58, respectively (Hair et al., 2011). The number of cases was adjusted for each analysis based on the cases available with complete data for the respective variables across all pre-program and post-program assessments. The R^2 values for the endogenous variables were then calculated to determine whether the amount of explained variance was small (0.25), moderate (0.50), or strong (0.75) (Hair et al., 2011).

Mediation was tested according to the following assumptions (see Figure 4): (a) variance in the independent variable significantly accounts for variations in the presumed mediator (i.e., Path A); (b) variations in the mediator significantly accounts for variations in the dependent variable (i.e., Path B); and (c) a previously significant relationship between the independent and dependent variables are no longer significant, after controlling for the independent variable (Path C) (Baron & Kenny, 1986).

All proposed models were examined using change scores related to the following data collection periods: entry – post-program; entry – 3 months; entry – 6 months; and entry – 12 months. Change scores were taken from entry to allow the waitlist period to serve as a control.

4.9.1.2 Objective 3.1. *The effect of changes in adolescent perceived parent support for physical activity on changes in adolescent physical activity behaviours will be mediated by changes in adolescent autonomous motivation for physical activity.*

The model testing the proposed hypothesis is shown in Figure 5 and was first explored using self-reported physical activity followed and then using accelerometer-based physical activity. The model with self-reported physical activity was tested using the 31 available cases from the data set that maintained adolescent reports of perceived parental support, autonomous motivation for physical activity, and physical activity behaviour across all assessment periods. The proposed mediation hypothesis was not supported when considering self-reported physical activity (see Table 23), and no direct effects were demonstrated (see Appendix QQ for full description).

The model based on accelerometer-based physical activity was run with 19 available cases up to 6-month follow-up using three intensity measures of physical activity: light, moderate-to-vigorous, and total (e.g., light and moderate-to-vigorous). The proposed mediation hypothesis of the effects was not supported when considering each intensity level of accelerometer-based physical activity (see Table 24). However, there was a significant direct effect of changes in adolescent perceived parent support for physical activity on changes in adolescent physical activity behaviour at 6 months for both light (β = .398, $p < .01$, R^2 = .158) and total physical activity (β = .403, $p < .01$, R^2 = .162). Sixteen percent (small) of the variation in changes in adolescent light intensity physical activity at 6 months was accounted for by changes in adolescent perceived parent support for physical activity. Similarly, 16.2% (small) of variation in changes in adolescent total physical activity was accounted for by changes in adolescent perceived parent support for physical activity at 6 months. The effect of changes in adolescent perceived parent support for physical activity

on adolescent light (β = .438, p < .05, R^2 = .231) and total (β = .439, p < .05, R^2 = .231) physical activity mediated by adolescent autonomous motivation for physical activity was shown to be significant at 6 months. However, the direct pathway from changes in adolescent perceived parent support for physical activity was not significant prior to mediation, thus the indirect relationship was not supported. Remaining direct and indirect paths were shown to be non-significant (see Appendix RR for full description).

4.9.1.2 Objective 3.2. *The effect of changes in adolescent perceived parent support for healthy eating on changes in adolescent healthy eating behaviours will be mediated by changes in adolescent autonomous motivation for healthy eating.*

Direct and indirect effects on adolescent healthy eating behaviours were modelled using two measures of adolescent healthy eating: junk food serves (see Figure 6) and combined serves of fruits and vegetables (see Figure 7). Both models were analysed using 22 cases from the data set with complete reports of adolescent food intake, adolescent perceived parent support for healthy eating, and adolescent autonomous motivation for healthy eating. Results of the analyses conducted for both models are shown in Table 25.

The proposed mediation hypothesis including adolescent junk food serves (Figure 6) was not supported, and no direct effects were demonstrated (see Appendix SS for a full description). Analyses of the proposed mediation hypothesis including adolescent fruit and vegetable serves (Figure 7) was not supported. However, changes in adolescent autonomous motivation for healthy eating was shown to directly and negatively predict changes in adolescent fruit and vegetable serves at 3 months (β = -.273, $p < .05$, R^2 = .075), with positive changes in adolescent autonomous motivation for healthy eating accounting for 7.5% (small) of the variance in reductions demonstrated in adolescent fruit and vegetable serves. The remaining paths were all shown to be non-significant (see Appendix TT for a full description).

4.9.1.3 Objective 3.3. *The effect of changes in adolescent perceived parent support (physical activity and healthy eating) on changes in adolescent health-related quality of life will be mediated by changes in adolescent autonomous motivation (physical activity and healthy eating).*

The relationship among changes in adolescent perceived parent support, autonomous motivation, and health-related quality of life was conceptualised in relation to both dimensions of healthy lifestyle behaviours. The first proposed mediation hypothesis explored this relationship in the context of physical activity (see Figure 8), and the second in the context of healthy eating (see Figure 9).

Pathways in the first model were analysed using data from the 31 cases with complete reports of adolescent perceived parent support for physical activity, autonomous motivation for physical activity, and health-related quality of life across all data collection periods. The second model was tested using the same 31 cases inclusive of a complete data set for the variables represented within the model. Findings of the path analyses are shown in Table 26 for both models. Beta coefficients for the relationship between changes in adolescent perceived parent support for physical activity and changes in adolescent autonomous motivation for physical activity were excluded from Table 26, as these were previously reported in relation to objective one (see Table 23), which employed the same sample as that used in analyses exploring proposed pathways in objective three. Beta coefficients for the relationship between changes in adolescent perceived parent support for healthy eating and changes in adolescent autonomous motivation for healthy eating are included in Table 26, as the sample used in exploring the proposed pathways in objective three varied from that used to explore the same relationship with regard to objective two.

The proposed mediation hypothesis predicting the effect of changes in adolescent perceived parent support for physical activity on changes in adolescent health-related quality of life mediated by changes in adolescent autonomous motivation for physical activity (Figure 8) was not supported. The indirect path was negative and significant at post-program (β = -.341, p < .05, R^2 = .186), however the direct pathway from changes in adolescent perceived parent support for physical activity to changes in adolescent autonomous motivation for physical activity was not significant prior to mediation.

Direct pathways shown to be significant included that from changes in adolescent autonomous motivation for physical activity to changes in adolescent health-related quality of life at 3 months (β = .437, p < .01, R^2 = .191), 6 months (β = .445, p < .01, R^2 = .198), and 12 months (β = .401, p < .01, R^2 = .161), although the direct path was not significant at post-program (β = .253, p > .05, R^2 = .064). That is, changes in adolescent autonomous motivation for physical activity accounted for 19.1% of the variance in adolescent health-related quality of life at 3 months, 19.8% (small) at 6 months, and 16.1% (small) at 12 months. The direct pathway from changes in adolescent perceived parent support for physical activity to changes in adolescent health-related quality of life was negative and significant at post-program (β = -.349, p < .05, R^2 = .116), with positive changes in adolescent perceived parent support for physical activity explaining 11.6% of the variance in reductions in adolescent health-related quality of life at post-program. Remaining direct and indirect paths in the model were not supported (see Appendix UU for a full description).

Analyses revealed the proposed mediation hypothesis of the effect of changes in adolescent perceived parent support for healthy eating on changes in adolescent health-related quality of life mediated by changes in adolescent autonomous motivation for healthy eating (Figure 9) was not supported. However, direct effects were shown for

changes in adolescent autonomous motivation for healthy eating predicting changes in adolescent health-related quality of life at 3 months (β = .497, p < .01, R^2 = .247). That is, changes in adolescent autonomous motivation for healthy eating accounted for 24.7% (small) of the variance in changes in adolescent health-related quality of life at 3 months. The direct path from changes in adolescent perceived parent support for healthy eating to changes in adolescent autonomous motivation for healthy eating was shown to be negative and significant at post-program (β = -.301, p < .05, R^2 = .090), with improvements in adolescent perceived parent support for healthy eating accounting for 9.0% (small) of the variance in reductions in adolescent autonomous motivation for healthy eating. The effect of changes in adolescent perceived parent support for healthy eating on health-related quality of life, mediated by adolescent autonomous motivation for healthy eating was negative and significant at post-program, (β = -.379, p > .05, R^2 = .166), but the indirect relationship was not supported due to the non-significant direct pathway prior to mediation from changes in adolescent perceived parent support for physical activity to changes in adolescent autonomous motivation for physical activity. All remaining direct and indirect pathways were not supported (see Appendix VV for a full description).

4.9.1.4 Objective 3.4. *The effect of changes in adolescent perceived parent support (physical activity and healthy eating) on changes in adolescent depressive symptoms will be mediated by changes in adolescent autonomous motivation (physical activity and healthy eating).*

Two models were proposed to assess the hypothesised relationship among changes in adolescent perceived parent support, autonomous motivation, and depressive symptoms in the context of both physical activity and healthy eating. The first proposed model examined the predicted pathways in relation to physical activity (see Figure 10), and the second model examined these pathways in relation to healthy eating (see Figure 11).

Thirty one cases with complete responses across all assessments were available in the data set for use in analysing proposed pathways in the both models. Table 27 presents findings from the analyses conducted on both models. Beta coefficients for the relationship between changes in adolescent perceived parent support (physical activity and healthy eating) predicting changes in adolescent autonomous motivation (physical activity and healthy eating) were excluded from Table 27 as these were previously reported in relation to objective one (physical activity; see Table 23) and objective 3 (healthy eating; see Table 26), which employed the same sample as that used in analyses exploring pathways proposed in objective four.

The proposed mediation hypothesis of the effect of changes in adolescent perceived parent support for physical activity on changes in adolescent depressive symptoms mediated by changes in adolescent autonomous motivation for physical activity (Figure 10) was not supported. Although the indirect effect was negative and significant at 3 months (β = -.420, $p < .01$, R^2 = .384) and 6 months (β = -.345, $p < .05$ R^2 = .215), the direct relationship from changes in adolescent perceived parent support for physical activity to changes in

adolescent autonomous motivation for physical activity was not significant prior to mediation. However, analyses revealed the direct path from changes in adolescent autonomous motivation for physical activity to changes in adolescent depressive symptoms was negative and significant at post-program (β = -.441, p < .01, R^2 = .195), 3 months (β = -.458, p < .01, R^2 = .210), 6 months (β = -.313, p < .01, R^2 = .098), and 12 months (β = -.436, p < .01, R^2 = .190), with improvements in adolescent autonomous motivation for physical activity accounting for 19.5% (small), 21.0% (small), 9.8% (small), and 19.0% (small) of variance in reductions in adolescent depressive symptoms, respectively. The direct pathway from changes in adolescent perceived parent support for physical activity to changes in adolescent depressive symptoms was also shown to be negative and significant at 3 months (β = -.456, p < .01, R^2 = .208) and 6 months (β = -.383, p < .01, R^2 = .146). Improvements in adolescent perceived parent support for physical activity therefore accounted for 20.8% (small) of the variance in reductions in adolescent depressive symptoms at 3 months (small) and 14.6% (small) at 6 months. The indirect pathway from changes in adolescent perceived parent support for physical activity to changes in adolescent depressive symptoms was also negative and significant at 3 months, (β = -.420, p < .01, R^2 = .384) and 6 months, (β = -.345, p < .05, R^2 = .215), although indirect effects were not supported due to the direct pathway from changes in adolescent perceived parent support for physical activity to changes in adolescent autonomous motivation for physical activity shown to be non-significant prior to mediation (see Appendix WW for a full description).

The proposed mediation hypothesis of the effect of changes in adolescent perceived parent support for healthy eating on changes in adolescent depressive symptoms mediated by changes in adolescent autonomous motivation for healthy eating (Figure 11) was negative and significant at 6 months, (β = -.334, p < .05, R^2 = .164), but the indirect effect

was not supported due to the direct pathway from changes in adolescent perceived parent support for physical activity to changes in adolescent autonomous motivation for physical activity shown to be non-significant prior to mediation. However, the direct path from changes in adolescent autonomous motivation for healthy eating to changes in adolescent depressive symptoms was negative and significant at 3 months (β = -.486, p < .01, R^2 = .219). Changes in perceived parent support for healthy eating also directly and negatively predicted changes in adolescent depressive symptoms at 6 months (β = -.369, p < .05, R^2 = .136). Improvements in adolescent autonomous motivation for healthy eating therefore accounted for 21.9% (small) of the variance in reductions in adolescent depressive symptoms at 3 months, and improvements in perceived parent support for healthy eating accounted for 13.6% of the variance in reductions in adolescent depressive symptoms at 6 months (see Appendix XX for full description).

4.9.2 Testing proposed models – Parent models. Proposed models used to explore mechanisms with regard to parent outcomes predicting adolescent perceptions and behaviours were comprised of one independent variable, one mediator variable, and two dependent variables (see Figure 12). Both dependent variables related to outcomes reported by adolescents, whereas the predictor variables reflected those reported by parents. Analyses were conducted in line with those reported for testing the adolescent models. Bootstrapping procedures in SmartPLS were employed to obtain t-values for path coefficients, with bootstrapping samples set to 5,000 and cases amended to reflect those available in the data set for each model. R^2 values for the endogenous variables were also calculated to determine the amount of explained variance. Analyses were again based on change scores at post-program assessments from entry (e.g., entry – post-program; entry – 3 months; entry – 6 months; and entry – 12 months).

4.9.2.1 Objective 3.5. *The effect of changes in parent autonomous motivation to support adolescent physical activity on changes in adolescent perceived parent support for physical activity and changes in adolescent physical activity behaviours will be mediated by changes in parent demonstration of need-supportive behaviours.*

The model testing the proposed hypothesis is shown in Figure 13 and was first explored using self-reported physical activity followed and then using accelerometer-based physical activity. Mediation including accelerometer-based physical activity was assessed using three levels of intensity: light, moderate-to-vigorous, and total (light and moderate-to-vigorous).

The model with self-reported physical activity was examined using 29 cases from the data set with complete reports of variables in the model across all assessment periods. The proposed mediation hypothesis (Figure 13) was not supported when considering self-reported physical activity (see Table 28). Although negative and significant indirect effects were demonstrated at post-program (β = -.423, p < .01, R^2 = .156), when testing mediation the direct relationship remained significant from changes in parent autonomous motivation to support adolescent physical activity to changes in parent demonstration of need-supportive behaviours. However, the predicted direct relationship between changes in parent autonomous motivation to support adolescent physical activity behaviour and parent demonstration of need-supportive behaviours was shown to be significant at post-program (β = .360, p < .05, R^2 = .130), with changes in parent autonomous motivation to support adolescent physical activity behaviour accounting for 13.0% (small) of the variance in changes in parent demonstration of need-supportive behaviours at post-program. The predicted direct effect of changes in parent autonomous motivation to support changes in adolescent physical activity on adolescent perceived parent support for physical activity was

however negative and significant at post-program (β = -.373, p < .05, R^2 = .139). That is, improvements in parent demonstration of need-supportive behaviours accounted for 13.9% (small) of the variation in reductions in adolescent perceived parent support for physical activity at post-program. All remaining direct and indirect paths were shown to be non-significant (see Appendix YY for a full description).

Seventeen available cases were considered for each intensity level of physical activity assessed in the model using accelerometer-based physical activity up to 6-month follow-up. The proposed mediation hypothesis (Figure 15) was not supported when considering each accelerometer-based physical activity intensity level (see Table 29). In addition, with the exception of light physical activity directly and negatively predicted at post-program (β = -.403, p < .05, R^2 = .163), no direct effects were shown for changes in parent autonomous motivation predicting changes in each level of adolescent physical activity. However, a positive and direct relationship was shown between changes in parent autonomous motivation to support physical activity and parent demonstration of need-supportive behaviours at post-program (β = .564, p < .01, R^2 = .318) when considering the 17 cases with accelerometer-based physical activity. Improvements in parent autonomous motivation to support physical activity therefore accounted for 31.8% (small to moderate) of the variance in improvements in parent demonstration of need-supportive behaviours at post-program. The direct path from changes in parent need-supportive behaviours to changes in adolescent light physical activity was however negative and significant at post-program (β = -.439, p < .05, R^2 = .193), 3 months (β = -.318, p < .05, R^2 = .101), and 6 months (β = -.477, p < .05, R^2 = .228), as was the direct path to total physical activity at post-program (β = -.366, p < .05, R^2 = .134) and 3 months (β = -.339, p < .05, R^2 = .115). Improvements in parent demonstration of need-supportive behaviours predicted 19.3% of

the variance (small) in reductions in light physical activity at post-program, 10.1% at 3 months, 22.8% at 6 months, as well as 13.4% of the variance in reductions in total physical activity at post-program and 11.5% at 3 months. The remaining direct and indirect paths were shown to be non-significant (see Appendix ZZ for a full description).

4.9.2.2 Objective 3.6. *The effect of changes in parent autonomous motivation to support adolescent healthy eating on changes in adolescent perceived parent support for healthy eating and changes in adolescent healthy eating behaviours will be mediated by changes in parent demonstration of need-supportive behaviours.*

The proposed model was tested using two measures of adolescent healthy eating: junk food serves (see Figure 14) and combined serves of fruits and vegetables (see Figure 15). Mediation effects were analysed in both models using the 21 cases from the data set with complete reports of each variable across all assessments periods. The proposed mediation hypothesis was not supported in either model (see Table 30). Although indirect effects were shown to be negative and significant at 6 months in predicting junk food (β = -.492, $p < .01$, R^2 = .252) and 3 months in predicting fruit and vegetable serves (β = -.302, $p < .05$, R^2 = .095), the direct relationship from parent autonomous motivation to support healthy eating to changes in parent demonstration of need-supportive behaviours was not significant prior to mediation at the respective time points. However, changes in parent autonomous motivation to support adolescent healthy eating were shown to negatively and directly predict changes in parent demonstration of need-supportive behaviours at post-program, (β = -.442, $p < .05$, R^2 = .195), adolescent perceived parent support for healthy eating at 3 months (β = -.715, $p < .01$, R^2 = .512), adolescent fruit and vegetable intake at 3 months (β = -.282, $p < .05$, R^2 = .079), and adolescent junk food intake at 6 months (β = -.498, $p < .01$, R^2 = .248). That is, improvements in parent demonstration of autonomous motivation to support adolescent healthy eating accounted for 19.5% (small) of the variation in reductions in parent demonstration of need-supportive behaviours at post-program, 51.2% (moderate) of the variation in reductions in adolescent perception of parent support for healthy eating at 3 months, 7.9% (small) of the variance in reductions in fruit

and vegetable intake at 3 months, and 24.8% (small to moderate) of the variation in reductions in adolescent junk food serves at 6 months. The remaining direct and indirect pathways were shown to be non-significant (see Appendix AAA for full description).

Chapter 5

Discussion

5.1 Introduction

The current study contributed to the available evidence-base on interventions targeting healthy lifestyle behaviour changes by examining intervention effects and motivational mechanisms underpinning a theory-based health behaviour-change (physical activity, healthy eating) intervention to promote weight loss and health outcomes in overweight and obese adolescents. The study was based on the integration of two theories of motivation, self-determination theory (Deci & Ryan, 2000) and goal setting theory (Locke & Latham, 1990), in a multi-disciplinary healthy lifestyle intervention for overweight and obese adolescents and their parents (Fenner et al., 2013; Straker et al., 2012). Specifically, multi-disciplinary teams of instructors were trained to provide need-supportive environments to foster parent and adolescent autonomous motivation for behaviour change, and parents were also trained to deliver these behaviours to further enhance adolescent autonomous motivation. Goal setting was also used to provide a framework for adolescents to integrate healthy lifestyle behaviours into their daily lives, and a structure for parents to implement behaviours to support adolescents' behaviour choices. Intervention components based on the integration of self-determination theory and goal setting theory were hypothesised to have an effect on adolescent healthy lifestyle behaviours (physical activity and healthy eating), quality of life (psychosocial, physical, and health), depressive symptoms, and self-determination theory outcomes related to adolescents and parents. In addition, the intervention was hypothesised to have positive effects on adolescents' behavioural (i.e., physical activity and healthy eating) as well as their psychological (i.e.,

health-related quality of life and depressive symptoms) outcomes through changes in parents' demonstration of need-supportive behaviours as well as adolescents' autonomous motivation.

Prior to the current study, interventions aiming to improve adolescent engagement in healthy lifestyle behaviours have not sought to integrate self-determination theory and goal setting theory. Further, no prior studies have aimed to train multi-disciplinary teams of instructors to deliver need-supportive environments to overweight and obese adolescents and their parents and to train parents of these adolescents in need-supportive environments to promote adolescent autonomous motivation for healthy lifestyle behaviours.

The current chapter summarises findings immediately following intervention and outcomes reported during the 12-month follow-up period. Changes in variables from the waitlist period are discussed, in addition to intervention fidelity, effects of the intervention, and findings from mediation analyses addressing direct and indirect relationships among variables at post-program periods. The application of study findings to the current evidence-base is then discussed. Finally, strengths and limitations of the study; both theoretical and clinical implications; and suggestions for future research are discussed.

5.2 Overview of Main Findings

5.2.1 Intervention fidelity. Consistent with previous research (Chatzisarantis & Hagger, 2009; Tessier et al., 2010), reports from instructors, participants, and external rater observations suggest that instructors were successfully trained such that intervention contexts were primarily perceived as need-supportive environments. The one instance in which an instructor was perceived to be providing a more needs-thwarting rather than needs-supporting environment, behaviours demonstrated by the additional multi-

disciplinary team members appeared to mitigate the degree to which participants' perceived intervention environments as primarily needs-thwarting. Overall, these findings indicate that effects of the intervention can be interpreted within the context of participants' receipt of a need-supportive intervention environment.

Despite relatively consistent demonstrations of overall need-supportive environments across instructors, minimal adherence to the promotion of intrinsic goals and autonomous goal strivings was promoted by the majority of instructors. While no instructors were observed to promote extrinsic or needs-thwarting strivings for goals, according to the tenets of self-determination theory the limited promotion of more need-supportive goal setting strategies may have reduced goal attainment and subsequent behavioural outcomes. However, the extent to which verbal instructions influenced goal pursuits may have been mitigated by the text provided on participants' goal setting sheets that stipulated setting intrinsic goals that were there underpinned by autonomous motives for goal strivings. Conclusions in regard to the influence of instructors' primary neglect of need-supportive goal promotion environments are however restricted due to the limited return of goal attainment scores.

5.2.2 Adolescent outcomes. The current intervention aimed at training and parents in the provision of need-supportive behaviours was proposed to have an effect on adolescent perceptions of parent need-support (objectives 2.1 and 2.2), autonomous motivation (objectives 2.3 and 2.4), behaviour engagement (objectives 2.5 and 2.6), and psychological outcomes (objective 2.7 and 2.8). Training parents in the provision of need-supportive behaviours was also hypothesised to indirectly predict changes in adolescent behavioural (objectives, 3.1 and 3.2) and psychological outcomes (objectives 3.3. and 3.4) through changes in adolescents' autonomous motivation. Effects of the intervention and

underlying mechanisms are discussed below within the context of each proposed mediation model. Discussions reporting on effects of the intervention are also introduced in accordance with the variables explored within the respective mediation model.

5.2.2.1 Physical activity and underlying mechanisms (objectives 2.1, 2.3, 2.5, and 3.1). Consistent with the tenets of self-determination theory (Deci & Ryan, 2000), an intervention aimed at training parents in need-supportive behaviours was effective in promoting significant changes in adolescent perceived parent support for physical activity up to 6 months following intervention, as well as significant changes in adolescent autonomous motivation for physical activity at 6 and 12 months. However, significant direct effects were only demonstrated at 6 months between changes in adolescent perceived parent support for physical activity and adolescent light and total physical activity. Although findings at 6 months are consistent with those demonstrated in the physical education domain (Hagger et al., 2003), and are the first to report on objective measures of changes in adolescent physical activity in the predict path, the lack of a direct relationship demonstrated at post-program and 3 months suggests inconclusive evidence regarding potential benefits for increasing light and total physical activity based on perceptions of parent support.

In regard to moderate-to-vigorous physical activity, the negative direction of non-significant findings at post-program and 3 months is inconsistent with previous research in physical education settings (Sebire, Jago, et al., 2013; Verloigne et al., 2011). Within self-determination theory it is posited that need-supportive environments are associated with enhanced behavioural engagement. Based on findings from the current study, one's perceptions of an environment as need-supportive may not be sufficient in some instances to overcome a true deficit in need-support provided within the environment. Although

measures of adolescent perceptions and parent reports of need-supportive behaviour demonstrations were collected in the current study, understanding changes in parent demonstration of need-supportive behaviours from an independent rater may have enhanced the ability to assess the relationship between parent demonstration of need-supportive behaviours and adolescent changes in physical activity. Previous studies in the physical education context have been primarily delivered without adolescents' awareness of intervention delivery. Hence, changes in support demonstrated in physical education settings were likely to have not been confounded by observing significant others' attendance at intervention and follow-up assessments. Given a higher intensity of physical activity (e.g., moderate-to-vigorous) is typically a behaviour that individuals have difficulty in maintaining (Fogelholm, 2008), findings from the current study suggest that perceptions of support in the absence of a substantial need-supportive environment is likely not sufficient to foster changes for more difficult to change behaviours unless parents are shown to actually improve intensity of resource distribution.

Similarly, the lack of a relationship between changes in adolescent perceived parent support for physical activity and autonomous motivation for physical activity, despite continued increases in autonomous motivation for physical activity during the maintenance period, suggests that adolescents may have derived support from additional sources beyond that provided by parents. For instance, evidence from the physical education domain suggests that instructor support may have enduring effects (Cheon et al., 2012). Adolescents in the current study may therefore have been autonomously motivated due to a combination of perceived support from instructors and parents.

The finding that changes in adolescent autonomous motivation for physical activity did not directly predict self-report or objective measures of physical activity is in contrast to

the tenets of self-determination theory (Deci & Ryan, 2000). However, inconsistencies between self-reported and objective measures in the direction of the predicted path from autonomous motivation across all follow-up points suggest potential self-report biases. Objective measures are posited to provide a more accurate representation of physical activity in comparison to self-report measures, which are more susceptible to reporting bias (Sallis & Saelens, 2000) associated with social desirability and challenges in estimating duration and frequency (Taber et al., 2009). Given the opposite directions shown between the two measures of physical activity, adolescents may have perceived their physical activity to be matched to their degree of autonomous motivation, and thus did not continue to engage in additional physical activity.

For instance, it is possible that adolescents perceived increases in physical activity as being greater than actual engagement, and thus falsely perceived physical activity levels to be aligned with their changes in autonomous motivation. Previous studies have demonstrated that changes in autonomous motivation are not necessarily matched with significant changes in physical activity when feedback is no longer present (Gao, 2012). While content in the current study addressed accurate self-monitoring, adolescents may have retreated from adhering to feedback methods that could provide an indication of their physical activity engagement levels (i.e., pedometer, measuring heart-rate) during post-program periods. Findings from samples of overweight and obese adolescents suggest that participants in this population are more likely to have inflated perceptions of time spent in physical activity (Corder et al., 2010), which is likely to explain adolescents' belief that their changes in self-reported physical activity, albeit non-significant, matched their changes in autonomous motivation.

Finally, despite a positive direct relationship for changes in adolescent autonomous motivation for physical activity mediating changes in perceived parent support for physical activity to changes in adolescent light and total physical activity at 6 months, the remaining direct pathways were not significant prior to mediation, and thus the indirect relationship was not supported. Similarly, although effect sizes at post-program indicate that a significant negative indirect path may have been demonstrated in relation to moderate-to-vigorous physical activity at post-program, the lack of direct relationships prior to mediation indicate the indirect pathway would not have been supported in a larger sample.

Although the lack of support for the indirect path from changes in adolescent perceived parent support for physical activity to physical activity is inconsistent with self-determination theory (Deci & Ryan, 2000), results are consistent with previous findings in prospective and intervention studies with adolescent samples in physical education settings (e.g., Chatzisarantis & Hagger, 2009; Hagger et al., 2003). One explanation for the lack of findings may be the exclusion of need satisfaction in the model. Specifically, including need satisfaction in the model such that changes in need satisfaction would mediate changes in adolescent perceived parent support for physical activity to changes in adolescent autonomous motivation, and autonomous motivation would then predict physical activity. Although cross-sectional studies in adolescent samples have demonstrated inconsistent outcomes when including need satisfaction in accordance with the proposed pathway (e.g., Koka, 2013a; Ntoumanis, 2005; Standage et al., 2012), results from intervention trials with adults that have demonstrated a non-significant indirect pathway from perceived need-supportive behaviours (e.g., from health-care providers and intervention instructors) to physical activity have found the mediated relationship became significant when need satisfaction for competence was included in the model (Fortier, Sweet, O'Sullivan, &

Williams, 2007; Teixeira, Carraça, Markland, Silva, & Ryan, 2012). Expanding the model proposed in the current study to include not only adolescent need satisfaction for competence, but also autonomy and relatedness, may therefore provide support for the indirect pathway from changes in adolescent perceived parent support to changes in adolescent engagement in physical activity. This suggests that changes in adolescent perceptions of parent support may indirectly influence changes in adolescent physical activity engagement, but the effectiveness of perceptions in predicting behaviour are limited by the degree to which changes in actual behaviour demonstrations are undertaken that support changes in adolescents' needs and subsequent changes in autonomous motivation.

5.2.2.2 Healthy eating and underlying mechanisms (objectives 2.2, 2.4, 2.6, and 3.2). The current study showed that training parents in need-supportive behaviours was effective in promoting significant changes in adolescent perceptions of parent support for healthy eating at post-program. Perceptions of parent support also remained elevated during the maintenance period, although these changes were no longer significantly different to perceptions at pre-intervention. Following intervention and during the maintenance period, improvements were also shown in fruit and vegetable serves compared to the waitlist period, although these changes were not significant. Significant changes were however demonstrated in adolescent autonomous motivation for healthy eating and adolescent junk food serves at post-program and all follow-up periods at 3, 6, and 12 months. However, conclusions with regard to junk food serves are tentative given significant changes were also found during the waitlist period. Although means following intervention were still shown to be significantly different to the significant changes demonstrated over the waitlist period, given that changes occurred during the waitlist

period it is not clear whether changes following intervention were due to real differences or self-report bias (Hare, Sherrill-Mittleman, Klesges, Lanctot, & Klesges, 2012).

Contrary to previous cross-sectional evidence (Morrison et al., 2013), no direct relationship was found between changes in adolescent perceived parent support and adolescent autonomous motivation for healthy eating (e.g., considering the sample of 22 cases from objective 2 and the 31 cases from objective 3). The finding that changes in adolescent perceived parent support for healthy eating did not directly predict changes in adolescent junk food intake as well as fruit and vegetable intake was also inconsistent with the tenets of self-determination theory (Deci & Ryan, 2000). However, this was the first study to examine these relationship following intervention and the effect size at post-program suggests the lack of a significant findings at post-program for both direct relationships was limited by sample size. The lack of a significant direct relationship during the maintenance period, despite significant improvements in autonomous motivation, suggests that the intervention was likely effective in promoting adolescents' internalization of motivation for healthy eating. Specifically, despite reductions in parent support during the maintenance period, adolescents continued to internalize their motivations for healthy eating as a result of exposure to the need-supportive intervention inclusive of instructors' and parents' behaviours during the intervention.

In addition, the significant direct pathway from changes in adolescent autonomous motivation for healthy eating to changes in adolescent fruit and vegetable serves at 3 months was shown to be negative, whereas remaining pathways were non-significant. Although these findings are inconsistent with those demonstrated in samples of adults exposed to instructors trained in need-supportive behaviours (e.g., Shaikh et al., 2011), the current study is the first to explore this relationship during the maintenance phase following

intervention in a sample of adolescents. These null findings, as well as a lack of significant changes in adolescents' consumption of food that must be provided (i.e., fruit and vegetables), rather than avoided (i.e., junk food), further supports the contention that adolescents were likely to have lasting effects of the intervention on their autonomous motivation, but were not able to necessarily act in healthier ways due to a lack of support from parents.

The pattern of direct relationships between all variables in the model cumulatively suggests that changes in adolescents' initial perceptions of changes in parent support for health eating as well as support provided by instructors is likely to improve adolescent autonomous motivation for healthy eating, but the degree to which autonomously motivated behaviours can influence uptake of healthy eating behaviours may be limited if parental support returns to baseline levels. Specifically, albeit non-significant primarily due to lack of statistical power, when changes were in the hypothesised direction for adolescent perceived parent support for healthy eating predicting adolescent autonomous motivation for healthy eating and fruit and vegetable serves, adolescent autonomous motivation for healthy eating was in the positive direction for predicting fruit and vegetable serves, as was the indirect relationship among these variables. However, when limited support for direct relationships were present, changes in autonomous motivation and changes in support for healthy eating were not associated with positive changes in fruit and vegetable serves. These findings suggest that changes in perceptions of parent support for healthy eating are important in predicting healthy eating behaviours, and attempts should be made to assist parents to remain need-supportive during maintenance periods to promote sustained changes in adolescents' healthy eating.

Similarly, significant reductions in junk food serves across all post-program periods suggests the lack of a relationship between changes in adolescent perceived parent support for healthy eating in predicting changes in adolescent reduction in junk food may be due to the need for a greater intensity of actual demonstration of parent need-supportive behaviours to foster changes in adolescent healthy eating behaviours. More specifically, although parents improved on their delivery of need-supportive behaviours at post-program, demonstration of behaviours returned to baseline levels during maintenance, which was previously associated with a lack of sufficient provision of need-supportive behaviours. Observations from independent raters are likely to provide a more accurate reflection of changes in parent demonstration of need-supportive behaviours, and thus further explain the variance in adolescent autonomous motivation and changes in adolescent engagement in healthy eating behaviours predicted by changes in adolescent perceived parent support for healthy eating.

Although there was no indirect effect of changes in adolescent perceived parent support for healthy eating on changes in adolescent healthy eating behaviours mediated by changes in adolescent autonomous motivation for healthy eating, effect sizes in relation to fruit and vegetable serves as the dependent variable do however suggest that the indirect relationship may have been significant if drawn from a larger sample. However, the direct path from changes in adolescent autonomous motivation to changes in fruit in vegetable serves was likely to still be non-significant prior to mediation if drawn from a larger sample, thus the proposed mediation was likely to not be supported regardless of sample size. This further supports the contention that adolescents likely derived their autonomous motivation from need-support provided during the intervention, but the incongruence between continued internalization and parents' reduction in need-supportive behaviours

meant changes in healthy eating were not mediated by changes in adolescents' autonomous motivation for healthy eating.

5.2.2.3 Health-related quality of life and underlying mechanisms (objectives, 2.7 and 3.3). Analyses revealed the intervention was successful in promoting changes in adolescent health-related quality of life at post-program, 3 months, and 6 months. Despite improvements at post-program, significant effects of the intervention on physical quality of life were only present at 3 months and 6 months, as well as at 6 months for psychosocial quality of life. Overall, these findings suggest that adolescents benefited from exposure to the intervention.

In addition to these novel findings in relation to training parents of adolescents in need-supportive behaviours, the current study was also the first to investigate the indirect effect of changes in adolescent perceived parent support for physical activity and healthy eating on changes in adolescent health-related quality of life mediated by changes in adolescent autonomous motivation (physical activity and healthy eating) following intervention.

Results of the current study extended previous cross-sectional findings (Gillison et al., 2006; Standage & Gillison, 2007; Standage et al., 2012) by demonstrating that changes in adolescent autonomous motivation for physical activity were directly related to changes in health-related quality of life at 3, 6, and 12 months, as was autonomous motivation for healthy eating at 3 months. Further, the effect size at 12 months suggests that with an increased sample size, the positive direct path from changes in adolescent autonomous motivation for healthy eating to changes in adolescent health-related quality of life is likely to be significant.

However, in contrast to previous studies in which physical education teachers' behaviours were manipulated experimentally (Mouratidis et al., 2008), changes in adolescent perceived parent support (physical activity and healthy eating) were not shown to directly predict changes in adolescent health-related quality of life during periods following intervention. Although not significant and predominately very small effect sizes were demonstrated, relationships were however in the hypothesised direction for all follow-up periods. Improvements in health-related quality of life were thus likely to have been related to adolescents deriving support from sources external to parents, such as intervention instructors.

Contrary to study hypotheses, changes in adolescent autonomous motivation did not mediate the relationship between changes in perceived parent support (physical activity and healthy eating) and adolescent health-related quality of life. The presence of significant direct effects and the absence of indirect effects suggest that additional mechanisms are likely to assist in explaining the indirect effect of perceived parent support on health-related quality of life (Standage et al., 2005; Standage & Gillison, 2007). Similar to predicting behaviour outcomes, including need-support in the proposed model may help account for variance explained within the model. Specifically, including need satisfaction in the model such that changes in need satisfaction would mediate changes in adolescent perceived parent support (physical activity and healthy eating) predicting changes in adolescent autonomous motivation, and autonomous motivation would then predict health-related quality of life (Standage & Gillison, 2007).

5.2.2.4 Depressive symptoms and underlying mechanisms (objectives 2.8 and 3.4). Reductions in depressive symptoms were demonstrated following intervention, however differences in symptom reductions were not significantly less than those reported prior to

intervention. Despite a lack of an intervention effect on depressive symptoms, analysis of underlying mechanisms revealed that improvements in adolescent perceived parent support for physical activity directly predicted reductions in adolescent depressive symptoms at 3 month and 6 month follow-up. Improvements in adolescent autonomous motivation for physical activity also directly predicted reductions in depressive symptoms at post-program, 3 months, 6 months, and 12 months. Results of mediation analyses are consistent with previous cross-sectional research in samples of adolescents and samples of obese adults following intervention (Ornelas et al., 2007; Vieira et al., 2011), and provide the first demonstration of these relationships with respect to perceptions of parent need-support behaviours following intervention. The absence of intervention effects prior to including self-determination theory variables as predictors of adolescent depressive symptoms further highlights the need to consider adolescent perceptions of parent support for physical activity and autonomous motivation for physical activity in predicting depressive symptoms. Although the indirect pathway from changes in adolescent perceived parent support for physical activity to changes in adolescent depressive symptoms was negative and significant at 3 months and 6 months, the direct pathway from autonomous motivation to depressive symptoms also remained significant, thus the indirect pathway was not supported.

Focusing on the proposed paths in relation to healthy eating, mediation analyses revealed the majority of proposed paths were in the hypothesised direction (e.g., negative). However, the only significant relationships were demonstrated in adolescent autonomous motivation for healthy eating directly predicting reductions in adolescent depressive symptoms at 3 months, and improvements in adolescent perceived parent support for healthy eating directly predicting reductions in adolescent depressive symptoms at 6

months. The effect size statistic at post-program does however suggest a likely negative direct relationship from changes in adolescent autonomous motivation for healthy eating to changes in adolescent depressive symptoms at post-program, but there was insufficient statistical power to confirm the effect statistically. However, the significant indirect effect demonstrated in the absence of direct effects prior to testing mediation indicate that changes in adolescent autonomous motivation for healthy eating did not mediate the pathway from changes in adolescent perceptions of parent support for healthy eating to reductions in adolescent depressive symptoms. Interestingly, support for the direct pathway from changes in self-determination theory variables predicting changes in adolescent depressive symptoms was more consistently demonstrated in relation to physical activity, rather than healthy eating. The lower levels of autonomous motivation and perceived parent support for healthy eating, compared to physical activity, may not have been sufficient to consistently predict depressive symptoms. Self-determination theory variables are thus likely to have a similar influence on depressive symptoms in relation to both healthy lifestyle behaviour contexts, but focusing on need-supportive environments and autonomous motivation in relation to physical activity may be a better avenue for reducing depressive symptoms than targeting self-determination theory variables in the context of healthy eating. Nonetheless, given the predicted paths are primarily in the hypothesised direction, interventions in the healthy eating context should still consider the potential benefits of promoting need-supportive intervention contents.

5.2.3 Parent self-determination theory outcomes. In line with the tenets of self-determination theory, the current study sought to determine the effects of an intervention targeting parents' training in need-supportive behaviours on parents' autonomous motivation to support adolescents' healthy lifestyle behaviours (objective 2). Parents'

receipt of training in need-supportive behaviours was also proposed to positively predict changes in adolescent perceived parent support and engagement in physical activity (objective 3.5) and healthy eating behaviours (objective 3.6) through changes in parent-reported demonstration of need-supportive behaviours. Effects of the intervention and underlying mechanisms are again discussed within the context of each proposed mediation model, and effects of the intervention introduced in accordance with the variables explored within the respective mediation model.

5.2.3.1 Physical activity and underlying mechanisms (objectives 2.9, 2.11, and 3.5).

Training parents in need-supportive behaviours within an instructor led need-supportive intervention environment was shown to be effective at increasing parents' autonomous motivation to support adolescent physical activity and parent-reported demonstration of need-supportive behaviours at post-program. Consistent with previous cross-sectional findings regarding physical education teachers, parent autonomous motivation to support adolescent physical activity was shown to directly predicted parent-reported demonstration of need-supportive behaviours (I. M. Taylor, Ntoumanis, & Standage, 2008) at post-program (accelerometer and self-reported sample). However, effects of the intervention on parents' autonomous motivation to support adolescent physical activity as well as the direct relationship in predicting changes in adolescent autonomous motivation for physical activity was no longer significant during the maintenance period. These findings suggest that consistent with the tenets of self-determination theory (Deci & Ryan, 2000), parents' autonomous motivation to support their adolescents can be enhanced, and these changes predict parents' demonstration of need-supportive behaviours. However, additional need-support may be required during the maintenance period to ensure benefits from intervention are sustained.

However, changes in adolescent physical activity (self-report and accelerometer) were not directly predicted by changes in parent autonomous motivation to support physical activity, and changes in parent-reported demonstration of need-supportive behaviours were not shown to predict changes in adolescent perceived parent support for physical activity. In addition, effect sizes at post-program suggest the direct relationship from changes in parent autonomous motivation to support adolescent physical activity and adolescent total physical activity would likely have been negative and significant in a larger sample.

In contrast to previous findings in the physical education domain (I. M. Taylor & Ntoumanis, 2007), parent autonomous motivation to support adolescent physical activity negatively and directly predicted adolescent perceived parent support (self-report sample) and changes in adolescent light physical activity (accelerometer sample) at post-program. Changes in parent-reported demonstration of need-supportive behaviours also negatively and directly predicted light physical activity at post-program, 3 months, and 6 months, as well as total physical activity at post-program and 3 months. Further, effect sizes demonstrated at 6 months suggest that with a larger sample size, the negative direct relationship from changes in parent demonstration of need-supportive behaviours to adolescent total physical activity is likely to be significant.

These findings add to the limited evidence-base, which to date only includes a single study reporting on minimal maintenance of changes in objective measures of moderate-to-vigorous physical activity in children following parent training in need-supportive behaviours related to healthy lifestyle behaviours (Jago et al., 2013). Findings from the current study suggest that although parents may perceive improvements in their demonstration of need-supportive behaviours, if they do not actually engage in more supportive behaviours there is

likely to be a mismatch between parent and adolescent perceptions of positive changes in parents' supportive behaviours, as well as adolescents' engagement in physical activity behaviours in relation to parent reports of autonomous motivation to support adolescent physical activity and need-supportive behaviour demonstrations. For instance, if parents believe they are demonstrating need-supportive behaviours, then they may not perceive a need to engage in additional supportive behaviours, which is likely to create a home environment that thwarts, rather than supports adolescents' needs.

Actual intensity of parent need-supportive behaviours may have been influenced by parents' uptake of content due to parents' potential lack of understanding of their role in contributing to their adolescents' obesity (Lindelof et al., 2010; Twiddy et al., 2012). If parents were more prepared to learn need-supportive methods, the effects of training may have been sustained more consistently at a greater intensity. In addition, although the delivery of intervention content was integrated with providing need-supportive behaviours, the importance of focusing on need-supportive behaviours may have been diluted in parents' attempts to integrate all educational concepts delivered. Therefore, in parents' attempts to sustain changes during the post-program period, the focus of concepts to address may have shifted away from the necessary intensity (e.g., required for adolescent behaviour change) of need-supportive behaviour demonstrations in an attempt to balance additional educational concepts (i.e., methods for eating healthier) with daily life. These limitations may have also contributed to a lack of findings demonstrated in respect to the hypothesised indirect relationship between parent autonomous motivation and adolescent physical activity, through changes in parent-reported demonstration of need-supportive behaviours (objective 5).

Findings should, however, be interpreted with caution given the sample sizes with objective measures of physical activity in both the parent and adolescent models were below the minimum recommended for analyses. Further, relationships demonstrated in relation to parent autonomous motivation to support adolescent physical activity are tentative given significant differences shown during the waitlist period. In addition, significant differences were shown in parent autonomous motivation to support adolescent physical activity between completers and those who dropped out prior to program start. Means for parent-reported demonstration of need-supportive behaviours at entry and pre-program also appear elevated in contrast to cross-sectional evidence that has shown parents of overweight and obese children are more likely to demonstrate lower levels of need-supportive behaviours than parents of normal weight adolescents (Pescud & Pettigrew, 2012; Timperio et al., 2013).

5.2.3.2 Healthy eating and underlying mechanisms (objectives 2.10 and 3.6).

Analyses of changes in mean differences revealed no significant post-program changes in parents' autonomous motivation to support adolescent healthy eating. In contrast to the hypothesised direction (Van den Berghe et al., 2013), a negative direct relationship was also shown from changes in parent autonomous motivation to support healthy eating to changes in parent demonstration of need-supportive behaviours at post-program, as well as changes in adolescent perceived parent support for healthy eating and changes in adolescent fruit and vegetable serves at 3 months. In line with hypothesised relationships, improvements in parent autonomous motivation to support adolescent healthy eating negatively and directly predicted reductions in junk food serves. However, results in relation to junk food serves are tentative given the significant differences found during the waitlist period

Similar to interventions conducted in adult samples (Shaikh et al., 2011), the intervention may have had a significant effect on parents who were lower in autonomous motivation to support adolescent healthy eating at entry. For these parents the association between enhanced autonomous motivation and delivery of need-supportive behaviours may have been more gradual, as suggested by the positive, although not significant, direct relationships at all follow-up periods from changes in parent autonomous motivation to support healthy eating to changes in adolescent perceptions of parent support for healthy eating. Although the pattern of data supports this hypothesis, due to low sample size, analyses could not be divided accordingly. However, the negative direct (both significant and non-significant) relationship from changes in parent autonomous motivation to support adolescent healthy eating to changes in adolescent perceived parent support for healthy eating suggest that similar to the physical activity domain, parent perceptions of their autonomous motivation to support adolescent healthy eating are not necessary matched with adolescent perceptions of parent support for healthy eating and adolescent engagement in healthy eating behaviours. The negative relationship between changes in parent autonomous motivation to support adolescent healthy eating and changes in parent demonstration of need-supportive behaviours is in contrast to the positive relationship demonstrated in regard to physical activity. These domain differences suggest that autonomous motivation may not be sufficient, and perhaps even detrimental, if parents are not able to adequately access resources to support healthy eating. For instance, it has been suggested that consuming a diet high in energy dense foods costs less than purchasing healthier foods such as fruits and vegetables (Konttinen, Sarlio-Lähteenkorva, Silventoinen, Männistö, & Haukkala, 2013). The current study was conducted in areas classified as low-socioeconomic, which suggests that participating parents may have been more likely to

experience environmental constraints. Therefore, the influence of parents' autonomous motivation on their behaviour outcomes, as defined within self-determination theory, may be restricted in instances when tangible resources play a more substantive role (i.e., in contrast to physical activity).

The current study is also the first to examine the importance of considering changes in these parent variables in relation to predicting changes in adolescent healthy eating behaviours following intervention. However, the relationship between changes in parent autonomous motivation to support adolescent healthy eating and adolescent engagement in healthy eating behaviours is still not fully understood given changes in parent demonstration of need-supportive behaviours did not predict changes in adolescent fruit and vegetable intake and perceived parent support for healthy eating, which is consistent with the lack of relationship demonstrated in respect to the physical activity domain in the current study. Further, the relationship between changes in parent autonomous motivation to support adolescent healthy eating and changes in adolescent junk food intake is tentative given changes were demonstrated during the waitlist period in adolescent junk food serves. Adolescent response bias in underreporting junk food intake (Hare et al., 2012) may have therefore influenced outcomes in the current study.

The finding that changes in mean scores for fruit and vegetable intake did not increase a minimum of a single serve at points following intervention, while junk food serves continued to decrease across assessments from entry, suggests that adolescents were not necessarily offered more healthy choices of food alternatives through parent need-supportive behaviours, but instead may have chosen to simply eat less junk food. Adolescent changes may have therefore been associated with learning healthy eating concepts within the intervention, and deriving sources of autonomous motivation from

intervention participation given changes demonstrated up to 6 months in adolescent autonomous motivation for healthy eating.

Reductions in junk food through portion control has been shown to be a more preferred strategy than increasing consumption of fruit and vegetables (Karfopoulou, Mouliou, Koutras, & Yannakoulia, 2013), which also suggests that although there may be a relationship between parent autonomous motivation and demonstration of need supportive behaviours, for more difficult-to-change behaviours (e.g., intake of fruits and vegetables), adolescents may require a greater intensity of parent demonstration of need-supportive behaviours. Given means for parent-reported demonstration of need-supportive behaviours were elevated during the waitlist period in comparison to what is suggested in cross-sectional results (Loth et al., 2013; Timperio et al., 2013), and elevated during follow-up periods in comparison to limited changes in adolescent behaviours, potential response bias in parents' reporting of need-supportive demonstration may have influenced outcomes in the current study.

Contrary to study hypotheses, changes in parent autonomous motivation to support adolescent healthy eating did not indirectly predict changes in adolescent healthy eating behaviours and changes in adolescent perceived parent support mediated by changes in parent demonstration of need-supportive behaviours. Parent response bias may have also contributed to the lack of ability to demonstrate a relationship between the indirect relationships proposed in the current study. Given the small sample size, further research is also needed to determine if the lack of effects are due to extraneous variables or a limited sample size.

5.2.4 Adolescent and parent goal setting theory outcomes. The relationship among variables predicted in relation to adolescent (objectives 7 and 8) and parent (objectives 9

and 10) goal attainment could not be assessed in the current study due to insufficient data returned by program instructors. Changes in adolescent and parent autonomous motivation and adolescent engagement in physical activity and healthy eating behaviours therefore cannot be interpreted in relation to goal attainment. However, anecdotal feedback provided by instructors during booster sessions suggested that adolescents and parents found the goal setting structure to be burdensome and time consuming. Instructors suggested that the reported burden contributed to participants' lack of ability to focus on completing all aspects of goal setting and instead chose to focus on certain aspects of goal setting. For example, participants would record reasons for goals in line with self-determination theory and set an overall weekly goal, but failed to record specific goal details or difficulty ratings in line with goal setting theory.

5.3 Strengths of the Study

5.3.1 Longitudinal study. A notable strength of the current study was the use of a longitudinal design, which allowed immediate and long-term intervention effects to be assessed to ascertain the sustainability of associated changes. In addition, the inclusion of assessments at multiple time periods during the 12-month follow-up period enabled the potential identification of instances when changes occurred and the associated duration of maintenance. Understanding the pattern of changes following intervention is critical for identifying potential instances of relapse that could be targeted (i.e., booster sessions) in future interventions to assist in sustaining behaviour changes.

Findings from the current study indicate that changes in adolescent autonomous motivation for healthy lifestyle behaviours are likely to be sustained up to 12-months, although perceptions of parent support are less enduring during the maintenance period. Changes in parent autonomous motivation to support adolescent healthy lifestyle

behaviours and demonstration of need-supportive behaviours are also not likely to be maintained beyond the immediate post-program period. Further, changes in adolescent junk food are likely to be sustained over the 12-month maintenance period, and changes in adolescent quality of life are likely to peak at 6-months, with a return toward baseline levels in the second half-year period.

In relation to mechanisms underlying changes following intervention, findings from the current study indicate that paths predicting changes in adolescent healthy lifestyle behaviours are likely to peak several months following intervention (3 months and 6 months) but are not maintained in the long-term (e.g., 12 months). Whereas paths predicting changes in adolescent psychological outcomes are demonstrated from immediately post-program and maintained up to 6 months. Changes in parent-reported outcomes are also more likely to be demonstrated immediately post-program but are not likely to be maintained past the immediate program period.

5.3.2 Integration of goal setting theory and self-determination theory. The present study was also unique in that it was the first to integrate self-determination theory and goal setting theory in a behaviour change intervention targeting adolescent overweight and obesity. Given self-determination theory has been shown to be an effective theoretical framework for understanding behaviour change, and techniques for implementing behaviour plans in line with goal setting theory have been shown to be successful in maintaining long-term behaviour change, exploring the integration of these two theories was critical to advancing the understanding of potentially effective means for intervening to promote health behaviour change. Although outcomes were not able to be assessed in relation to goal attainment, the mapping of behaviour change techniques and the associated change mediators and behaviour outcomes reported, in relation to both

theories, provided the necessary level of description needed for replication (Abraham & Michie, 2008) and the identification of areas where integration could be improved in future interventions. Given the potential benefits of integrating both theories, future studies should seek to use the mapping procedures demonstrated in the current study, but with a more streamlined approach of guided goal setting to allow both reasons from self-determination theory and goal techniques from goal setting theory to be fully applied.

5.3.3 Training multi-disciplinary teams of instructors in need-supportive behaviours. A multi-disciplinary approach has been identified as a critical component of interventions targeting adolescent obesity (Melanson, 2009), yet no intervention for adolescents based on the tenets of self-determination theory has explored training instructors in need-supportive behaviours beyond those in the physical education profession. Multi-disciplinary teams of instructors were trained in the current study in two metropolitan and one regional location, and in the majority of instances instructors delivered program content across multiple cohorts. Based on rater observations and both adolescents' and parents' perceptions, instructors were shown to demonstrate need-supportive behaviours when delivering the intervention. Training multi-disciplinary teams of instructors in need-supportive behaviours is thus effective and likely to optimise outcomes associated with content delivered in each domain of instructor expertise. However, in some instances findings may be tentative given differences shown during the waitlist period.

5.3.4 Training parents of adolescents in need-supportive behaviours. Another major strength of the study was the investigation of outcomes associated with parents' training in need-supportive behaviours to promote adolescents' autonomous motivation for physical activity and healthy eating behaviours. No studies to date have explored the relationship among changes in parents' reported demonstration of need-supportive

behaviours, adolescents' perceptions of these changes, and adolescents' motivation for, and subsequent engagement in, healthy lifestyle behaviours as well as associated psychological outcomes. Although changes in parent reports of autonomous motivation to support adolescent healthy lifestyle behaviour changes and demonstration of need-supportive behaviours were not frequently aligned with adolescent perceptions of support behaviours or engagement in healthy lifestyle eating behaviours, findings suggest that parents nonetheless perceived positive changes in their own outcomes. Adolescents also benefited, particularly in relation to psychological outcomes, from perceiving parents as supportive, although support behaviours might not have necessarily been in place. However, in some instances findings may again be tentative given significant differences shown during the waitlist period.

5.3.5 Mapping parent behaviour change goals on to adolescent goals. An additional strength of the current study was the mapping of parent goals to support adolescent goals for behaviour change. The description of behaviour change techniques used to deliver goal setting in family-based interventions has to date been sparse at best (Shilts et al., 2013). Given parents' lack of understanding in their role within promoting adolescents' behaviour changes (Lindelof et al., 2010; Twiddy et al., 2012), the current study provides insight into one approach for providing parents with an explicit mapping structure by providing a means for implementing need-supportive behaviours within a motivational goal setting structure.

5.3.6 Objective measure of physical activity. The current study was the first to report on accelerometer-based measurement of adolescent physical activity following multi-disciplinary teams of instructors' and parents' receipt of training in need-supportive behaviours. More globally, findings from the current study contributed to the sparse literature available by reporting on objectively assessed measures of physical activity within

interventions grounded in social cognitive theories (Plotnikoff, Costigan, Karunamuni, & Lubans, 2013). Given the bias associated with self-report measures of physical activity, understanding changes in objectively assessed physical activity is critical for providing a more accurate reflection of changes in behaviour outcomes following intervention.

5.4 Limitations of the Study

5.4.1 Small sample of participants completing study. A major limitation of the current study was the sample. Conclusions with respect to objective measures of physical activity are tentative given the sample fell just short of the minimum recommended size for conducting analyses in SmartPLS. Although PLS analysis is recommended for, and is comparatively robust in, analyses where the sample size is comparatively small, any inferences derived from analyses adopting this statistical approach is still susceptible to problems associated with low statistical power due to small sample size. The small to moderate effect sizes in a number of instances when no significant relationship was demonstrated also suggests that findings were limited by lack of statistical power due to the small sample size. The sample in the current study was also derived from Western Australian metropolitan suburbs and a regional town classified as having a low socio-economic status, and was attended predominately by white[7] female adolescents and their parents. Previous research suggests that gender may have an influence on perceptions of need support (Ntoumanis, 2005). If a larger sample from both genders was available, the influence of gender could have been determined in the current study. In addition, although no parent demographic variables were collected, attendance records noted that, all adolescents were accompanied by their mothers, with the exception of one adolescent whose one mother/father pair attended and one adolescent whose sole father attended.

Given the high attrition rate, enrolled participants at 12 month follow-up may also represent a biased sample. Results from the current study therefore cannot be simply generalized to any overweight and obese adolescents and their parents. Instead, results are likely to be generalizable to program completers enrolled in similar interventions with similar sample characteristics. Despite these limitations, attrition rates are in line with previous studies reporting on family-behavioural lifestyle interventions (e.g., Jago et al., 2013), and thus the processes used in delivering this intervention based on the integration of self-determination theory and goal setting theory are still useful for informing future research and practice.

5.4.2 Missing goal attainment data. Findings from the current study were also limited by instructors' failure to collect post-program goal attainment data and set goals to attain at 3-month follow-up. Understanding the relationship among goal attainment, autonomous motivation, and behavioural outcomes is imperative for understanding the effectiveness of goal setting procedures based on the integration of self-determination theory and goal setting theory within the health behaviour domain. However, despite this study demonstrating increases in adolescent and parent autonomous motivation, as well as behaviour outcomes for adolescents, changes cannot necessarily be attributed to the use of a goal setting structure based on the integration of self-determination theory and goal-setting theory.

5.4.3 Lack of randomization to a control group. A potential limitation of the current design was the lack of randomization to condition. Random allocation is considered necessary if two groups of participants are assumed to be unbiased and equal at entry. Given the perceived difficulty in providing a true control considering community knowledge of interventions for adolescent obesity and the perceived unethical nature of prolonged

withholding of a valid intervention for adolescents in need, a staggered-cohort entry waitlist controlled design was employed in the current study. This methodological approach allowed the waitlist period to control for within-participant differences, akin to a control group, and the staggered entry controlled for external events that may have influenced outcomes.

5.4.4 Limitations of self-report and objective measures of adolescent healthy lifestyle outcomes. A potential limitation of the current study is the use of a self-report measure of healthy eating behaviours. Although 3-day food diaries have been suggested as the most valid and reliable self-report tool for measuring eating behaviours in adolescents (Livingstone & Black, 2003; Livingstone & Robson, 2000), evidence has demonstrated that underreporting is common in adolescents (Lioret et al., 2011). Overweight and obese adolescents are also at greater risk for underreporting, and these risks are shown to increase across multiple collection points (Hare et al., 2012). In the current study instances of limited support for hypothesised mediation relationships may therefore have been due to shortcomings associated with self-report measures of healthy eating behaviours. These shortcomings should be taken in to account when interpreting the current findings. However, future studies are also likely to be limited by the use of self-report measures given there are no alternative objective methods suitable for community interventions.

Self-report measures of physical activity were also used in the current study and were also likely to suffer from limitations associated with self-report measures, namely over-reporting of behaviour engagement, which is more common in overweight and obese adolescents (McMurray et al., 2008). Although the use of objective measures in the current study limited the effects of self-report bias for physical activity outcomes, accelerometer assessment could only be considered up to the 6 month follow-up period due to small sample size with accelerometer assessment at 12 months. Further, the sample size

consisting of available data for analyses using objective measures of physical activity was below the minimum recommendation for conducting mediation analyses in SmartPLS.

5.4.5 Potential for response bias. Contrary to findings in the current study, previous longitudinal research has demonstrated sustained changes in teachers' need-supportive behaviours and associated sustained changes in adolescent outcomes (i.e., autonomous motivation and physical activity behaviour engagement) following intervention (Cheon & Reeve, 2013; Cheon et al., 2012). However, previous findings have been limited to reports of students' and independent raters' perceptions of teachers' behaviours, and prior to the current study no measures of parent changes in need-supportive behaviours have been assessed.

Independent raters in the current study did not have access to rate parent behaviours within the home setting and thus reports of parent behaviours were limited to the perspective of parents and adolescents. Parents are susceptible to endorsing more socially desirable responses in an attempt to mitigate others' perceptions of blame for their adolescents' obesity (Haines, Neumark-Sztainer, Hannan, & Robinson-O'Brien, 2008; Herbert, Clemow, Pbert, Ockene, & Ockene, 1995). Therefore, the ability to fully understand the relationship among changes in adolescent behaviour outcomes and changes in parent predictor variables may have been limited.

5.4.6 Lack of a measure of adolescents' need satisfaction. Perceptions of instructors' and parents' demonstration of need-supportive behaviours were assessed in the current study as a means of determining if environmental provisions of need-supportive behaviours were successfully modified. Although perceptions of need-supportive behaviours have been shown to be a consistent predictor of autonomous motivation and subsequent behaviour engagement (Reeve, 2002), including measures of need-support may

have been necessary for explaining variance predicted in the proposed mediation relationships. However, the current study was conducted in the context of a broader study, and in order to limit response burden, while meeting objectives of both the current and broader study, assessment of need satisfaction could not be carried out.

5.4.7 Delivery of training in theoretical content within a broader intervention. Although previous studies have shown brief intervention can be successful at modifying demonstration of need-supportive behaviours (e.g., McLachlan & Hagger, 2010b), delivery of need-supportive training within a multi-disciplinary intervention may have detracted from the importance parents placed on need-supportive behaviours. Previous trainings in need-supportive behaviours delivered to physical education teachers were not extended to include education on modification of healthy lifestyle behaviours beyond content addressing need-support. While training delivered to parents of children have, in contrast, included content addressing modification of healthy lifestyle behaviours, need-supportive behaviour demonstrations were not measured, making it difficult to ascertain if the delivery of need-supportive behaviours in the long-term suffered from training being delivered in the context of additional healthy lifestyle behaviour concepts. Despite attempts in the current study to integrate need-supportive behaviours with education on healthy lifestyle behaviours, parents may have felt burdened by the amount of information delivered and thus may not have been able to prioritize need-supportive behaviours as a strategy to maintain in the long-term.

Further, asking participants to consider thinking of reasons for goals and setting specific and difficult goals in a proximal/distal framework for multiple behaviour changes may have been an overwhelming burden. Benefits of the integrated content may have subsequently suffered due to straining participants' resources available to devote full

adherence to implementing integrated theoretical content for goal setting procedures. Consequently, participants may have been selective in their adherence to certain techniques used in setting goals.

5.4.8 Need-supportive behaviours of one parent in the household. The current study was also limited to the modification of behaviours for one parent within each adolescent's home environment. Although parents attending the intervention were the primary parent responsible for the delivery of behaviours to support adolescents' physical activity and healthy eating, behaviours provided by other guardian figures in adolescents' environment (e.g., partner of participating parent, grandparents) have been shown to influence adolescent behaviour (i.e., Loth et al., 2013).

5.4.9 Parents' generalized causality orientations. Rater observations of sessions and feedback from instructors during booster sessions suggested that some parents were resistant to training in need-supportive behaviour and the proposition that their behaviours required further modification through goal setting behaviours. Previous studies have demonstrated that parents are often reluctant to take responsibility for demonstration of parenting behaviours associated with adolescents' obesity (Twiddy et al., 2012). Parents also report the desire for a "quick fix" and more frequent decisions to actively avoid their contributing role in managing/helping with adolescents' obesity (Lindelof, Nielsen, & Pedersen, 2011). Some parents in the current study may therefore have been misguided in their decision to enrol in the program under the false pretence that the multi-disciplinary program "covered all areas" (e.g., nutrition, physical activity, and psychological) and was thus a "quick fix" that would alleviate them of the necessary parenting role they play in managing/helping with/addressing their adolescents' obesity. As a result of this predisposition, some parents may have felt confronted by seemingly unexpected content

addressing parenting behaviours, which was likely perpetuated by continually addressing parenting behaviours in the CAFAP content across multiple disciplines.

5.4.10 Instructors' generalized causality orientations. Although reports from parents and adolescents showed instructors were perceived to favour a more autonomy-supportive delivery, mean observations from independent raters and instructor self-reports suggested levels of need-supportive behaviours were lower in some instructors. Investigations of training teachers in need-supportive behaviours has demonstrated that teachers can be trained to be need-supportive regardless of their causality orientations, however the effects of training may be more limited in those whose pre-dispositional state is more commonly controlling (Su & Reeve, 2011). In the current study, observation of one instructor (i.e., regional psychologist) from an independent rater suggested a more controlling, rather than autonomy-supportive instruction style, and attempts to help the instructor modify her behaviours were met with a lack of understanding of the need for delivering more need-supportive strategies. The instructors' causality orientations and reluctance to change may therefore have influenced the delivery of program content, resulting in inconsistency in delivery of an autonomy-supportive environment. Further, the instructor's behaviour demonstrations may have also attenuated effects on parent outcomes.

5.5 Theoretical Implications

Within self-determination theory it is posited that need-supportive environments will foster autonomous motivation and subsequent positive psychological and behavioural outcomes (Deci & Ryan, 2000). Findings from the current study suggest that changes in adolescent autonomous motivation fostered by changes in perceptions of parent support are likely to be sufficient for improving adolescent psychological outcomes. However,

changes in perceptions of parent support alone do not necessarily predict consistent outcomes in fostering adolescent autonomous motivation in relation to promoting engagement in healthy lifestyle behaviours. Instead, perceptions of need-support from instructors and parents during intervention may have a “carry-over” effect to the maintenance period, during which adolescents continue to internalize regulations fostered during the intervention period, even in instances when perceptions of parent support are diminished from levels shown during the intervention. This is consistent with previous studies suggesting that provision of need-support may have long-lasting effects on autonomous motivation (Pelletier et al., 2001).

Findings from the current study, however, suggest that the benefits of adolescents’ autonomously motivated behaviours are limited if resources are not ultimately provided for behaviour engagement. Within self-determination theory it is postulated that if individuals are autonomously motivated, a behaviour is more likely to be sustained (Deci & Ryan, 2000). However, the limited support for indirect effects of changes in perceptions of parent support in predicting changes in adolescent healthy lifestyle behaviours in the current study, suggests that deriving autonomous motivation from alternative sources is not necessarily associated with behaviour change if needs are thwarted within the context that behaviours must be demonstrated. Previous studies aimed at training significant others in need-supportive behaviours have been primarily carried out in physical education settings, which provide a direct arena for adolescents’ behaviour engagement within the context of the need-supportive environment promoted through training (Van den Berghe et al., 2012). Consumption of fruit and vegetables, in comparison to junk food consumption (i.e., avoidance food) or engaging in physical activity, requires the highest degree of parental need-support and this was the only behaviour outcome in the current study to be

consistently, and negatively, related to autonomous motivation. It is therefore imperative for future interventions based on self-determination theory to move beyond the physical education setting and into the home environment to target parents' autonomous motivation to provide need-supportive behaviours if adolescents are to gain benefits from being autonomously motivated.

Previous research exploring outcomes associated with the delivery of training in need-supportive behaviours within physical education settings is also likely to comprise a disproportionate amount of individuals who engage in physical activity in comparison to the unique population of parents of overweight and obese adolescents. As such, it can be argued that physical education teachers' orientations are more likely to be autonomously motivated to support physical activity than parents of overweight and obese adolescents (Harris & Standage, 2014; Rooney, Mathiason, & Schauberger, 2011). Although there is no defined duration of time required to effectively foster autonomously motivated behaviour, it could be speculated that individual differences may influence the duration of intervention required to promote autonomous motivation in those whose predispositions are more controlling. While studies have demonstrated that teachers whose orientations are more controlling in nature tend to score lower on provisions of autonomy support following training, in comparison to those whose orientations were more autonomous in nature, no longitudinal research has assessed potential differences in need-supportive behaviour demonstrations as a variant of one's orientation.

Based on findings from the current study that suggest that parents' autonomous motivation may be enhanced during intervention, which also positively influences their need-supportive behaviour demonstrations, and adolescents' autonomous motivation, understanding how to continue to foster autonomous motivation is necessary in

understanding the application of self-determination theory to reducing adolescent obesity. Applied more broadly to the tenets of self-determination theory, findings suggest that it may prove fruitful to understand if individual differences do exist in the extent to which one requires substantial intervention to internalize motivations.

Although needs are postulated in self-determination theory to be universal, evidence from previous findings indicated in some instances that individual factors may also influence perceptions of need-support (Edmunds et al., 2010; Ntoumanis, 2005). The sample of participants in the current study was unique to those involved in previous research in that families were recruited from low-socioeconomic areas and relational patterns with the significant other trained in need-supportive behaviours was well-established. Based on findings in the current study, individual factors such as financial access to resources and well-established relational patterns may have influenced the ability for parents to maintain sustained changes in their behaviours. Findings from the current study suggest that in this particular population it is necessary to consider if more tangible resources influence parents' ability to provide need-support, and if causality orientation influence parents' autonomous motivation to support adolescents. Understanding the influence of potential individual differences on self-determination theory variables should therefore be expanded to include experiences of barriers, and how these might influence the degree to which autonomous motivations may influence behaviours.

5.6 Clinical Implications

Results of the current study indicate that interventions targeting the promotion of need-supportive environments in intervention and home settings may have the potential to be effective when set within a goal setting structure for implementing behaviour changes. However, interventions targeting parents as a change mechanism may need to consider placing substantial emphasis at program start on the relationship between parent behaviour and adolescent obesity, as well as exploring parents' beliefs, values, and pre-dispositions (Su & Reeve, 2011). This is likely to better prepare parents for understanding the necessity for learning and implementing need-supportive behaviours and may relax their opposition to changing current behaviour states (Reeve, 2009). Further, given the deep seated relational patterns between adolescents and their parents it is likely that additional intervention may be necessary to sustain motivational mechanisms posited in self-determination theory (Gillison et al., 2013). Similar to longitudinal interventions seeking to train teachers in need-supportive behaviours (e.g., Cheon & Reeve, 2013), providing booster training sessions in need-supportive behaviours and goal setting may help encourage changes made during intervention and reducing attrition (Su & Reeve, 2011).

The delivery of integrated content in the current study may also have proved too overwhelming for both instructors and adolescents, thus goal setting have been viewed as a controlling exercise imposed by instructors, rather than a motivational framework for enhancing behaviour engagement. Participants' willingness to engage in goal setting may therefore be encouraged by reducing participant workload by providing a more guided approach to goal choices within the framework of goal setting theory and self-determination theory. Although participants were provided with a list of suggested goals in the current study, similar to that used in guided goal setting (Shilts et al., 2009), structuring

content such that participants must choose set goals from a list provided, rather than using the list of goals as a guide for self-set goals, may prove fruitful as a means for streamlining goal selection within the context of self-determination theory and goal setting theory while providing the perception of choice in goal pursuits. Experimental studies manipulating goal contents and motives for goals, as well as difficulty, specificity, and proximity, have all demonstrated success when goals are set for participants (i.e., Bandura & Simon, 1977; Ntoumanis et al., 2013; Vansteenkiste, Simons, Soenens, et al., 2004), which suggests guided goal setting is likely to still be need-supportive but also successful in assisting to motivate and implement behaviour change.

Finally, delivery of content based on the integration of self-determination theory and goal setting theory may be best placed by first introducing behaviour change mechanisms within each theory and then addressing each healthy lifestyle behaviour sequentially, rather than simultaneously. This would allow concepts from self-determination theory and goal setting theory to be more easily understood and applied in the context of a single healthy lifestyle behaviour, which could then be more readily and successfully applied when undertaking modifications to additional healthy lifestyle behaviours in a progressive manner.

5.7 Recommendations for Future Research

The current study provided a unique contribution to the literature by exploring processes underpinning adolescent changes in behavioural and psychological outcomes in a multi-disciplinary family-based healthy lifestyle intervention grounded in the integration of self-determination theory and goal setting theory. Despite the contribution of the current study, additional aspects may be built upon in future studies to improve understanding of these processes.

5.7.1 Sample size. The ability to detect changes in healthy lifestyle behaviours within the proposed mediation pathways was likely limited in the current study due to the small sample size and limited statistical power. Further research is therefore needed in larger samples to fully understand the proposed relationships between variables in the current study. Specifically, small to moderate effect sizes shown to be non-significant in the current study would likely have been significant if drawn from a larger sample. Objective measures of physical activity also fell just short of the recommended sample size for analyses using SmartPLS, and findings were therefore tentative in relation to accelerometer-based measures of physical activity. Given the benefits of objective measures and the limitations of self-report, future studies should seek to analyse similar pathways following intervention in larger samples.

5.7.2 Goal attainment outcomes. Given the widespread use of goal setting in health behaviour change interventions, future studies are needed to explore outcomes associated with adolescent and parent goal attainment to fully understand effects of family goal setting processes based on the integration of self-determination theory and goal setting theory. By sequentially, rather than simultaneously, introducing behaviour areas and the associated set goals for each behaviour area (e.g., physical activity, healthy eating, and sedentary behaviour) instructors and participants in future studies may have more resources to ensure study protocols are adhered to, thus enhancing the completion and collection of goal attainment scores for analyses.

5.7.3 Parent response bias. Future studies should consider means for reducing potential response biases in order to more accurately capture changes in parent autonomous motivation and need-supportive behaviour demonstrations following intervention. The validity of measures assessing parent behaviour may also be optimised

through brief interviews with parents and adolescents describing behaviour levels (Ntoumanis & Standage, 2009). This would potentially reduce response biases that may have confounded results in the current study. Although caution may need to be taken as participants may not necessarily respond favourably to the added response burden.

5.7.4 Measures of adolescents' need satisfaction. Future studies should also consider measures of adolescents' perceived need-support, which is likely to strengthen the predicted pathways proposed in the current study.

5.7.5 Delivery of training content. Further research is needed to determine optimal methods for delivering parent training based on the tenets of self-determination theory within the context of multi-disciplinary interventions. Future studies may benefit by extending the intervention duration to allow sequential rather than simultaneous delivery of theory-based content to avoid the potential of participants getting "lost" in the multiple streams of information delivered. Sequential delivery may also foster greater uptake of concepts to be more easily applied to additional behaviours (e.g., "carry-over effect) (Mata et al., 2009).

Future studies may also consider devoting substantial time at program start to exploring parents' role in their adolescents' obesity to ensure parents are open to taking on training in need-supportive behaviours. Assessment of the effectiveness of providing ongoing support (i.e., bi-monthly booster sessions) in training parents to deliver need-supportive behaviours may also be worthwhile to explore. Targeting the behaviours of additional others within the home context may also enable primary resource providers to more effectively support adolescents' behaviour changes, while also providing additional, and more consistent (Berge, Wall, Bauer, & Neumark-Sztainer, 2012), sources of need-support for adolescents.

5.8 Conclusion

The current study evaluated the theoretical underpinnings of an intervention for overweight and obese adolescents based on the integration of two motivational theories, self-determination theory and goal setting theory. The intervention led to changes in adolescent motivational, psychological, and behavioural outcomes as well as changes in parent motivational and supportive behavioural demonstrations. In terms of the theoretical underpinnings, although a number of direct relationships were shown between variables, the hypothesised mediation effects were not shown to be significant, and direct relationships identified at post-program, 3 months, and 6 months were no longer significant at 12-month follow-up. As such, the processes by which changes in adolescent healthy lifestyle behaviours and psychological outcomes occur in relation to parent training in need-supportive behaviours has yet to be confirmed empirically.

Determining the optimal method for delivering family-based interventions based on motivational theories is crucial to reducing the prevalence of overweight and obesity exhibited in many countries. The current study has contributed to understanding suitable methods for intervening with this large population of adolescents at particular risk of poor physical and mental health outcomes. Future studies should expand on the evidence presented in the current study by exploring the effectiveness of more intense parent training in need-supportive behaviours and a more streamlined integration of concepts from self-determination theory and goal setting theory within the context of a larger sample population.

References

Abbott, R., Macdonald, D., Stubbs, C., Lee, A., Harper, C., & Davies, P. (2008). Healthy Kids Queensland Survey 2006 - Full Report. Brisbane: Queensland Health.

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27*(3), 379-387. doi: 10.1037/0278-6133.27.3.379

Aelterman, N., Vansteenkiste, M., Van Keer, H., Van den Berghe, L., De Meyer, J., & Haerens, L. (2012). Students' objectively measured physical activity levels and engagement as a function of between-class and between student differences in motivation toward physical education. *Journal of Sport & Exercise Psychology, 34*, 457-480.

Alm, M., Soroudi, N., Wylie-Rosett, J., Isasi, C. R., Suchday, S., Rieder, J., & Khan, U. (2008). A qualitative assessment of barriers and facilitators to achieving behavior goals among obese inner-city adolescents in a weight management program. *The Diabetes Educator, 34*, 277-284. doi: 10.1177/0145721708314182

Armitage, C. J. (2007). Effects of an implementation intention-based intervention on fruit consumption. *Psychology & Health, 22*(8), 917-928. doi: 10.1080/14768320601070662

Ashford, S. J., & Cummings, L. L. (1983). Feedback as an individual resource: Personal strategies of creating information. *Organizational Behavior and Human Performance, 32*(3), 370-398. doi: 10.1016/0030-5073(83)90156-3

Australian Bureau of Statistics. (2012). *Australian health survey: First results, 2011-2012 (no. 4364.0.55.001)*. Canberra.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215. doi: 10.1037/0033-295x.84.2.191

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1989). Self-regulation of motivation and action through internal standards and goal systems. In L. A. Pervin (Ed.), *Goal concepts in personality and social psychology* (pp. 19-85). Hillsdale, NJ: Erlbaum.

Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes, 50*(2), 248-287. doi: 10.1016/0749-5978(91)90022-l

Bandura, A., & Cervone, D. (1986). Differential engagement of self-reactive influences in cognitive motivation. *Organizational Behavior and Human Decision Processes, 38*(1), 92-113. doi: 10.1016/0749-5978(86)90028-2

Bandura, A., & Schunk, D. H. (1981). Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. *Journal of Personality and Social Psychology, 41*(3), 586-598. doi: 10.1037/0022-3514.41.3.586

Bandura, A., & Simon, K. M. (1977). The role of proximal intentions in self-regulation of refractory behavior. *Cognitive Therapy and Research, 1*(3), 177-193. doi: 10.1007/bf01186792

Bandura, A., & Wood, R. (1989). Effect of perceived controllability and performance standards on self-regulation of complex decision making. *Journal of Personality and Social Psychology, 56*(5), 805-814.

Banting, L. K., Dimmock, J. A., & Grove, R. J. (2011). The impact of automatically activated motivation on exercise-related outcomes. *Journal of Sport & Exercise Psychology, 33*, 569-585.

Bar-Eli, M., Tenenbaum, G., Pie, J. S., Btesh, Y., & Almog, A. (1997). Effect of goal difficulty, goal specificity and duration of practice time intervals on muscular endurance performance. *Journal of Sports Sciences, 15*(2), 125-135. doi: 10.1080/026404197367407

Baranowski, T., Baranowski, J., Cullen, K., Thompson, D. I., Nicklas, T., Zakeri, I., & Rochon, J. (2003). The fun, food, and fitness project (FFFP): The Baylor GEMS pilot study. *Ethinicity and Disease, 13*, S1-30-S31-39.

Baron, R. M., & Kenny, D. A. (1986). the moderator-mediator variable distrinction in social psychological research: conceptual, strategical, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173-1182.

Bauer, K. W., Nelson, M. C., Boutelle, K. N., & Neumark-Sztainer, D. (2008). Parental influences on adolescents' physical activity and sedentary behavior: longitudinal findings from Project EAT-II. *International Journal of Behavioral Nutrition and Physical Activity, 5*(12). doi: 10.1186/1479-5868-5-12

Bauer, K. W., Neumark-Sztainer, D., Fulkerson, J. A., Hannan, P. J., & Story, M. (2011). Familial correlates of adolescent girls' physical activity, television use, dietary intake, weight, and body composition. *International Journal of Behavioral Nutrition and Physical Activity, 8*(25).

Bean, M. K., Mazzeo, S. E., Stern, M., Bowen, D. J., & Ingersoll, K. (2011). A values-based motivational interviewing (MI) intervention for pediatric obesity: Study design and methods for MI Values. *Contep Clin Trials, 32*(5), 667-674. doi: 10.1016/j.cct.2011.04.010

Bech-Larsen, T., & Grønhøj, A. (2013). Promoting healthy eating to children: a text message (SMS) feedback approach. *International Journal of Consumer Studies, 37*, 250-256. doi: 10.1111/j.1470-6431.2012.01133.x

Belcher, B. R., Berrigan, D., Dodd, K. W., Adae Emken, B., Chou, C. P., & Spuijt-Metz, D. (2010). Physical activity in US youth: Impact of race/ethnicity, age, gender, & weight status. *Med Sci Sports Exerc., 42*(12), 2211-2221. doi: 10.1249/MSS.0b013e3181e1fba9

Bell, L. M., Byrne, S., Thompson, A., Ratnam, N., Blair, E., Bulsara, M., . . . Davis, E. A. (2007). Increasing body mass index z-score is continuously associated with complications of overweight in children, even in the healthy weight range. *Journal of Clinical Endocrinology & Metabolism, 92*(2), 517-522. doi: 10.1210/jc.2006-1714

Bellg, A. J., Borrelli, B., Resnick, B., Hecht, J., Minicucci, D. S., Ory, M., . . . Czajkowski, S. (2004). Special NIH committee report - Enhancing treatment fidelity in health behavior change

studies: Best practices and recommendations from the NIH behavior change consortium. *Health Psychology, 23*, 443-451.

Berge, J. M. (2009). A review of familial correlates of child and adolescent obesity: What has the 21st century taught us so far? *Int J Adolesc Med Health, 21*(4), 457-483.

Berge, J. M., Wall, M. M., Bauer, K. W., & Neumark-Sztainer, D. (2012). Parenting characteristics in the home environment and adolescent overweight: A latent class analysis. *Obesity, 18*, 818-825. doi: 10.1038/oby.2009.324

Berkey, C. S., Rockett, H. R. H., Gillman, M. W., & Colditz, G. A. (2003). One-year changes in activity and in inactivity among 10- to 15-year-old boys and girls: relationship to change in body mass index. *Pediatrics, 111*(4), 836-843.

Berry, M. W., Danish, S. J., Rinke, W. J., & Smiciklas-Wright, H. (1989). Work-site health promotion: the effects of a goal-setting program on nutrition related behaviors. *Journal of the American Dietetic Association, 89*(7), 914-920.

Biddle, S. J. H., Fox, K. R., & Boutcher, S. H. (Eds.). (2000). *Physical activity and psychological well-being*. London: Routledge.

Birch, L. L., & Davison, K. K. (2001). Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. *Pediatric clinics of North America, 48*(4), 893-907.

Birch, L. L., Fisher, J. O., & Davison, K. K. (2003). Learning to overeat: maternal use of restrictive feeding practices promotes girls' eating in the absence of hunger. *The American Journal of Clinical Nutrition, 78*(2), 215-220.

Black, A. E., & Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. *Science Education, 84*(6), 740-756. doi: 10.1002/1098-237x(200011)84:6<740::aid-sce4>3.0.co;2-3

Bodenheimer, T., & Handley, M. A. (2009). Goal-setting for behavior change in primary care: An exploration and status report. *Patient Education and Counseling, 76*(2), 174-180. doi: 10.1016/j.pec.2009.06.001

Boiché, J. C. S., & Sarrazin, P. G. (2009). Proximal and distal factors associated with dropout versus maintained participation in organized sport. *Journal of Sports Science & Medicine, 8*(1), 9-16.

Boutelle, K. N., Birkeland, R. W., Hannan, P. J., Story, M., & Neumark-Sztainer, D. (2007). Associations between maternal concern for healthful eating and maternal eating behaviors, home food availability, and adolescent eating behaviors. *Journal of Nutrition Education and Behavior, 39*(5), 248-256. doi: 10.1016/j.jneb.2007.04.179

Boutelle, K. N., Birnbaum, A. S., Lytle, L. A., Murray, D. M., & Story, M. (2003). Associations between perceived family meal environment and parent intake of fruit, vegetables, and fat. *Journal of Nutrition Education & Behavior, 35*(1), 24-29.

Boutelle, K. N., Cafri, G., & Crow, S. J. (2011). Parent-only treatment for childhood obesity: A randomized controlled trial. *Obesity, 19*(3), 574-580.

Boutelle, K. N., Fulkerson, J. A., Neumark-Sztainer, D., Story, M., & French, S. A. (2007). Fast food for family meals: relationships with parent and adolescent food intake, home food availability and weight status. *Public Health Nutrition, 10*(01), 16-23. doi: 10.1017/S136898000721794X

Bradlee, M. L., Singer, M. R., Qureshi, M. M., & Moore, L. L. (2010). Food group intake and central obesity among children and adolescents in the Third National Health and Nutrition Examination Survey (NHANES III). *Public Health Nutrition, 13*(06), 797-805. doi: 10.1017/S1368980009991546

Bravata, D. M., Smith-Spangler, C., Sundaram, V., & et al. (2007). Using pedometers to increase physical activity and improve health: A systematic review. *JAMA, 298*(19), 2296-2304. doi: 10.1001/jama.298.19.2296

Broderick, C. (1993). *Understanding family process: Basics of family systems theory*. Thousand Oaks, CA: Sage Publications.

Brug, J., Glanz, K., Van Assema, P., Kok, G., & van Breukelen, J. P. (1998). The impact of computer-tailored feedback and iterative feedback on fat, fruit, and vegetable intake. *Health Education & Behavior, 25*(4), 517-531. doi: 10.1177/109019819802500409

Brunet, J., & Sabiston, C. M. (2010). Exploring motivation for physical activity across the adult lifespan. *Psychology of Sport and Exercise, 12*(2), 99-105. doi: 10.1016/j.psychsport.2010.09.006

Buchan, D. S., Ollis, S., Thomas, N. E., & Baker, J. S. (2012). Physical activity behaviour: An overview of current and emergent theoretical practices. *Journal of Obesity, 2012*(Article ID 546459), 11 pages. doi: 10.1155/2012/546459

Burke, L. E., Styn, M. A., Steenkiste, A. R., Music, E., Warziski, M., & Choo, J. (2006). A randomized clinical trial testing treatment preference and two dietary options in behavioral weight management: Preliminary results of the impact of diet at 6 months - PREFER Study. *Obesity, 14*(1), 2007-2017.

Burleson Daviss, W., Birmaher, B., Melhem, N. A., Axelson, D. A., Michaels, S. M., & Brent, D. A. (2006). Criterion validity of the Mood and Feelings Questionnaire for depressive episodes in clinic and non-clinic subjects. *Journal of Child Psychology and Psychiatry, 47*(9), 927-934. doi: 10.1111/j.1469-7610.2006.01646.x

Burnet, D. L., Plaut, A. J., Wolf, S. A., Huo, D., Solomon, M. C., Dekayie, G., . . . Chin, M. H. (2011). Reach-Out: A family-based diabetes prevention program for African American youth. *Journal of the National Medical Association, 103*(3), 269-277.

Burton, D. (1994). Goal setting in sport. In R. N. Singer, M. Murphey & L. K. Tennant (Eds.), *Handbook of research on sport psychology* (pp. 467-491). New Yrok: Macmillan.

Burton, D., & Weiss, C. (2008). The fundamental goal concept: The path to proces and performance success. In T. S. Horn (Ed.), *Advances in sport psychology* (3rd ed., pp. 340-375). Champaign, IL: Human Kinetics.

Butler, J. M., Fortenberry, K. T., Berg, C. A., McCabe, J., Blakemore, T., & Wiebe, D. J. (2011). Early adolescents' goals and mothers' accuracy in predicting adolescent goals in the context of Type 1 Diabetes. *Children's Health Care, 40*(2), 155-169. doi: 10.1080/02739615.2011.564940

Cairney, J., Kwan, M. Y. W., Velduizen, S., Hay, J., Bray, S. R., & Faught, B. E. (2012). Gender, perceived competence and the enjoyment of physical education in children: a longitudinal examination. *International Journal of Behavioral Nutrition and Physical Activity, 9*(26). doi: 10.1186/1479-5868-9-26

Campbell, K., Crawford, D., Salmon, J., Carver, A., Garnett, S. P., & Baur, L. A. (2007). Associations between the home food environment and obesity-promoting eating behaviors in adolescence. *Obesity, 15*(3), 719-730.

Campbell, M., Benton, J. M., & Werk, L. N. (2011). Parent perceptions to promote a healthier lifestyle for their obese child. *Social Work in Health Care, 50*(10), 787-800. doi: 10.1080/00981389.2011.597316

Carraça, E. V., Markland, D., Silva, M. N., Coutinho, S. R., Vieira, P. N., Minderico, C. S., . . . Teixeira, P. J. (2011). Dysfunctional body investment versus body dissatisfaction: Relations with well-being and controlled motivations for obesity treatment. *Motivation and Emotion, 35*(4), 423-434. doi: 10.1007/s11031-011-9230-0

Carraro, N., & Gaudreau, P. (2011). Implementation planning as a pathway between goal motivation and goal progress for academic and physical activity goals. *Journal of Applied Social Psychology, 41*(8), 1835-1856. doi: 10.1111/j.1559-1816.2011.00795.x

Centers for Disease Control and Prevention. (2002). Centers for Disease Control and Prevention CDC Growth Charts: CDC table for calculated body mass index values for selected heights and weights for ages 2 to 20 years. Retrieved October 31, 2012, from www.cdc.gov/growthcharts

Chatzisarantis, N. L. D., & Hagger, M. S. (2007). The moral worth of sport reconsidered: Contributions of recreational sport and competitive sport to life aspirations and psychological well-being. *Journal of Sports Sciences, 25*(9), 1047-1056. doi: 10.1080/02640410600959954

Chatzisarantis, N. L. D., & Hagger, M. S. (2009). Effects of an intervention based on self-determination theory on self-reported leisure-time physical activity participation. *Psychology & Health, 24*(1), 29-48. doi: 10.1080/08870440701809533

Cheon, S. H., & Reeve, J. (2013). Do the benefits from autonomy-supportive PE teacher training programs endure?: A one-year follow-up investigation. *Psychology of Sport and Exercise, 14*(4), 508-518. doi: 10.1016/j.psychsport.2013.02.002

Cheon, S. H., Reeve, J., & Moon, I. S. (2012). Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers be more autonomy supportive toward their students. *Journal of Sport & Exercise Psychology, 34*, 365-396.

Chiang, E. S., & Padilla, M. A. (2012). Assessment of parent orientation towards autonomy vs. control in promoting children's healthy eating and exercise. *Applied Psychology: Health and Well-Being, 4*(2), 202-217. doi: 10.1111/j.1758-0854.2012.01069.x

Chin, W. W. (1998). The partial least squares approach for structural equation modeling. In G. A. Marcoulides (Ed.), *Modern methods for business research* (pp. 295-336). London: Lawrence Erlbaum Assocaites.

Chirkov, V. I., & Ryan, R. M. (2001). Parent and teacher autonomy-support in Russian and U.S. adolescents. *Journal of Cross-Cultural Psychology, 32*(5), 618-635. doi: 10.1177/0022022101032005006

Chirkov, V. I., Ryan, R. M., & Willness, C. (2005). Cultural context and psychological needs in Canada and Brazil. *Journal of Cross-Cultural Psychology, 36*(4), 423-443. doi: 10.1177/0022022105275960

Colley, R. C., & Tremblay, M. S. (2011). Moderate to vigorous physical activity intensity cut-points for the Actical accelerometer. *J Sports Sci, 29*(8), 783-789. doi: 10.1080/02640414.2011.557744

Consolvo, S., Klasnja, P., McDonald, D. W., & Landay, J. A. (2009). *Goal-setting considerations for persuasive technologies that encourage physical activity*. Paper presented at the Proceedings of the 4th International Conference on Persuasive Technology, Claremont, California.

Contento, I. R., Koch, P. A., Lee, H., & Calabrese-Barton, A. (2010). Adolescents demonstrate improvement in obesity risk behaviors after completion of Choice, Control & Change, a curriculum addressing personal agency and autonomous motivation. *Journal of American Dietetic Association, 110*, 1830-1893. doi: 10.1016/j.jada.2010.09.015

Cooke, L. J., Chambers, L. C., Añez, E. V., Croker, H., Boniface, D., Yeomans, M. R., & Wardle, J. (2012). Eating for pleasure or profit: the effect of incentives on children's enjoyment of vegetables. *Psychol Sci., 22*(2), 190-196. doi: 10.1177/0956797610394662

Corder, K., Ekelund, U., Steele, R. M., Wareham, N. J., & Brage, S. (2008). Assessment of physical activity in youth. *Journal of Applied Physiology, 105*(3), 977-987. doi: 10.1152/japplphysiol.00094.2008

Corder, K., van Sluijs, E. M. F., McMinn, A. M., Ekelund, U., Cassidy, A., & Griffin, S. J. (2010). Perception versus reality: awareness of physical activity levels of british children. *American Journal of Preventive Medicine, 38*(1), 1-8. doi: 10.1016/j.amepre.2009.08.025

Costello, E. J., & Angold, A. (1988). Scales to assess child and adolescent depression: Checklists, screens, and nets. *Journal of the American Academy of Child and Adolescent Psychiatry, 27*(6), 726-737.

Costello, E. J., Benjamin, R., Angold, A., & Silver, D. (1991). Mood variability in adolescents: a study of depressed, nondepressed and comorbid patients. *J. Affect. Disord., 23*, 199-212.

Cox, A. E., Smith, A. L., & Williams, L. (2008). Change in physical education motivation and physical activity behavior during middle school. *Journal of Adolescent Health, 43*, 506-513. doi: 10.1016/j.jadohealth.2008.04.020

Cullen, K. (2011). A review of the existing literature on obesity in children and young people and a commentary on the psychological issues identified *Obesity in the UK: A psychological perspective* (pp. 56-65). Leicester: British Psychological Society.

Cullen, K. W., Baranowski, T. O. M., & Smith, S. P. (2001). Using goal setting as a strategy for dietary behavior change. *Journal of the American Dietetic Association, 101*(5), 562-566. doi: 10.1016/S0002-8223(01)00140-7

Cullen, K. W., Thompson, D. I., Scott, A. R., Lara-Smalling, A., Watson, K. B., & Konzelmann, K. (2010). The impact of goal attainment on behavioral and mediating variables among low income women participating in an Expanded Food and Nutrition Education Program intervention study. *Appetite, 55*(2), 305-310. doi: DOI: 10.1016/j.appet.2010.06.017

Cumming, J. (2008). Investigating the relationship between exercise Imagery, leisure-time exercise behavior, and self-efficacy. *Journal of Applied Sport Psychology, 20*(2), 184-198. doi: 10.1080/10413200701810570

Currie, K., Hurrelmann, W., Settertobulte, W., Smith, R., & Todd, J. (2000). Health and health behaviour among young people: Health behaviour in school-aged children: A WHO cross-national study (HBSC) international report. Copenhagen: WHO Regional Office for Europe.

Davison, K. K., Francis, L. A., & Birch, L. L. (2005). Reexamining obesigenic families: Parents' obesity-related behaviors predict girls' change in BMI. *Obesity Research, 13*(11), 1980-1990.

De Beer, M., Hofsteenge, G. H., Koot, H. M., Hirasing, R. A., Delemarre-van de Waal, H. A., & Gemke, R. (2007). Health-related-quality-of-life in obese adolescents is decreased and inversely related to BMI. *Acta Pædiatrica, 96*(5), 710-714. doi: 10.1111/j.1651-2227.2007.00243.x

de Nooijer, J., de Vet, E., Brug, J., & de Vries, N. K. (2006). Do implementation intentions help to turn good intentions into higher fruit intakes? *Journal of Nutrition Education and Behavior, 38*(1), 25-29. doi: 10.1016/j.jneb.2005.11.021

de Ridder, D. T. D. (2012). Themed issue: Plans, norms, motivation, and cheating a little - The curious case of healthy eating. *Psychology & Health, 27*(sup2), 1-6. doi: 10.1080/08870446.2012.721957

de Vet, E., Oenema, A., & Brug, J. (2011). More or better: Do the number and specificity of implementation intentions matter in increasing physical activity? *Psychology of Sport and Exercise, 12*(4), 471-477. doi: 10.1016/j.psychsport.2011.02.008

de Vries, H., Kremers, S. P. J., Smeets, T., Brug, J., & Eijmael, K. (2008). The effectiveness of tailored feedback and action plans in an intervention addressing multiple health behaviours. *American Journal of Health Promotion, 22*(6), 417-425. doi: 10.4278/ajhp.22.6.417

De Vries, H., Kremers, S. P. J., Smeets, T., & Reubsaet, A. (2008). Clustering of diet, physical activity and smoking and a general willingness to change. *Psychology and Health, 23*(3), 265-278. doi: 10.1080/14768320701349107

Deci, E. L., Driver, R. E., Hotchkiss, L., Robbins, R. J., & Wilson, I. M. (1993). The relation of mothers' controlling vocalizations to children's intrinsic motivation. *Journal of Experimental Child Psychology, 55*(2), 151-162. doi: 10.1006/jecp.1993.1008

Deci, E. L., Eghrari, H., Patrick, B. C., & Leone, D. R. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality, 62*(1), 119-142. doi: 10.1111/j.1467-6494.1994.tb00797.x

Deci, E. L., & Ryan, R. M. (1980). The empirical exploration of intrinsic motivational processes. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 13, pp. 39-80). New York: Academic.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press.

Deci, E. L., & Ryan, R. M. (1991). A motivational approach to self: integration in personality. In R. Dienstbier (Ed.), *Nebraska symposium on motivation: Vol. 38. Perspectives on motivation* (pp. 237-288). Lincoln, NE: University of Nebraska Press.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry: An International Journal for the Advancement of Psychological Theory, 11*(4), 227-268. doi: 10.1207/S15327965PLI1104_01

Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology, 49*(1), 14.

Dietz, W. H. (1994). Critical periods in childhood for the development of obesity. *The American Journal of Clinical Nutrition, 59*(5), 955.

Donaldson, E. L., Fallows, S., & Morris, M. (2013). A text message based weight management intervention for overweight adults. *Journal of Human Nutrition and Dietetics*. doi: 10.1111/jhn.12096

Donovan, J. J., & Radosevich, D. J. (1998). The moderating role of goal commitment on the goal difficulty - performance relationship: A meta-analytic review and critical reanalysis. *Journal of Applied Psychology, 83*(3), 308-315.

Donovan, J. J., & Williams, K. J. (2003). Missing the mark: Effects of time and causal attributions on goal revision in response to goal-performance discrepancies. *Journal of Applied Psychology, 88*(3), 379-390. doi: 10.1037/0021-9010.88.3.379

Duda, J. (2004). Goal setting and achievement motivation in sport. *Encylopedia of Applied Psychology, 2*, 109-119.

Duncan, L. R., Hall, C. R., Wilson, P. M., & Jenny, O. (2010). Exercise motivation: A cross-sectional analysis examining its relationships with frequency, intensity, and duration of exercise. *International Journal of Behavioral Nutrition and Physical Activity, 7*(7).

Dupont, J.-P., Carlier, G., Gérard, P., & Delens, C. (2009). Teacher-student negotiations and its relation to physical education students' motivational processes: An approach based on self-determination theory. *European Physical Education Review, 15*(1), 21-46. doi: 10.1177/1356336x09105210

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annu. Rev. Psychol., 53*, 109-132.

Edmunds, J. A., Duda, J. L., & Ntoumanis, N. (2010). Psychological needs and the prediction of exercise-related cognitions and affect among an ethnically diverse cohort of adult women. *International Journal of Sport and Exercise Psychology, 8*(4), 446-463. doi: 10.1080/1612197X.2010.9671963

Edmunds, J. A., Ntoumanis, N., & Duda, J. L. (2006). A test of self-determination theory in the exercise domain. *Journal of Applied Social Psychology, 36*(9), 2240-2265. doi: 10.1111/j.0021-9029.2006.00102.x

Edmunds, J. A., Ntoumanis, N., & Duda, J. L. (2007). Perceived autonomy support and psychological need satisfaction in exercise. In M. S. Hagger & N. L. D. Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 35-52). Champaign, Illinois: Human Kinetics.

Eisenberg, M. E., Olson, R. E., Neumark-Sztainer, D., Story, M., & Bearinger, L. H. (2004). Correlations between family meals and psychosocial well-being among adolescents. *Arch Pediatr Adolesc Med, 158*(8), 792-796. doi: 10.1001/archpedi.158.8.792

Epstein, L. H. (1996). Family-based behavioral intervention for obese children. *Int J Obes Relat Metab Disord, 20*(Suppl 1), S14 - 21.

Epstein, L. H., Paluch, R. A., Beecher, M. D., & Roemmich, J. N. (2008). Increasing healthy eating vs. reducing high energy-dense foods to treat pediatric obesity. *Obesity, 16*(2), 318-326. doi: 10.1038/oby.2007.61

Ezendam, N. P. M., Burg, J., Borsboom, G., van Empelen, P., & Oenema, A. (2012). Differential effects of the computer-tailored FATaintPHAT programme on dietary behaviours according to sociodemographic, cognitive and home environmental factors. *Public Health Nutrition, FirstView*, 1-9. doi: 10.1017/S1368980012005344

Fairclough, S., Hilland, T., Stratton, G., & Ridgers, N. (2012). 'Am I able? Is it worth it?' Adolescent girls' motivational predispositions to school physical education: Associations with health-enhancing physical activity. *European Physical Education Review, 18*(2), 147-158. doi: 10.1177/1356336x12440025

Fairclough, S., & Stratton, G. (2005). 'Physical education makes you fit and healthy'. Physical education's contribution to young people's physical activity levels. *Health Education Research, 20*(1), 14-23. doi: 10.1093/her/cyg101

Fenner, A. A., Straker, L. M., Davis, M. C., & Hagger, M. S. (2013). Theoretical underpinnings of a need-supportive intervention to address sustained healthy lifestyle changes in overweight and obese adolescents. *Psychology of Sport and Exercise, 14*(6), 819-829. doi: 10.1016/j.psychsport.2013.06.005

Fjeldsoe, B. S., Neuhaus, M., Winkler, E., & Eakin, E. (2011). Systemic review of maintenance of behavior change following physical activity and dietary interventions. *Health Psychology, 30*(1), 99-109. doi: 10.1037/a0021974

Fogelholm, M. (2008). How physical activity can work? *International Journal of Pediatric Obesity, 3*(S1), 10-14. doi: 10.1080/17477160801896481

Fortier, M. S., Duda, J., Guerin, E., & Teixeira, P. J. (2012). Promoting physical activity: development and testing of self-determination theory-based interventions. *International Journal of Behavioral Nutrition and Physical Activity, 9*, 20.

Fortier, M. S., Sweet, S. N., O'Sullivan, T. L., & Williams, G. C. (2007). A self-determination process model of physical activity adoption in the context of a randomized controlled trial. *Psychology of Sport and Exercise, 8*(5), 741-757. doi: 10.1016/j.psychsport.2006.10.006

Frahm-Templar, M. J., Estabrooks, P. A., & Gyurcsik, N. C. (2003). The role of goal difficulty and specificity in the prediction of exercise participation. *AVANTE, 9*(1), 38-48.

Freedman, D. S., Khan, L. K., Serdula, M. K., Dietz, W. H., Srinivasan, S. R., & Berenson, G. S. (2005). The relation of childhood BMI to adult adiposity: The Bogalusa Heart Study. *Pediatrics, 115*, 22-27. doi: 10.1542/peds.2004-0220

Friedman, R., Deci, E. L., Elliot, A. J., Moller, A. C., & Aarts, H. (2010). Motivational synchronicity: Priming motivational orientations with observations of others' behaviors. *Motivation and Emotion, 34*(1), 34-38. doi: 10.1007/s11031-009-9151-3

Gammage, K., Hall, C., & Rodgers, W. M. (2000). More about exercise imagery. *The Sport Psychologist, 14*, 348-359.

Gao, Z. (2012). Motivated but not active: The dilemmas of incorporating interactive dance into gym class. *Journal of Physical Activity and Health, 9*, 794-800.

Gaudreau, P., Carraro, N., & Miranda, D. (2012). From goal motivation to goal progress: the mediating role of coping in the Self-Concordance Model. *Anxiety, Stress & Coping, 25*(5), 507-528. doi: 10.1080/10615806.2011.628015

Gerards, S. M. P. L., Sleddens, E. F. C., Dagnelie, P. C., de Vries, N. K., & Kremers, S. P. J. (2011). Interventions addressing general parenting to prevent or treat childhood obesity. *International Journal of Pediatric Obesity, 6*(2Part2), e28-e45. doi: 10.3109/17477166.2011.575147

Giacobbi, P., Hausenblas, H. A., Fallon, E., & Hall, C. (2003). Even more about exercise imagery: A grounded theory of exercise imagery. *Journal of Applied Sport Psychology, 15*(2), 160-175. doi: 10.1080/10413200305391

Gibson, E. L., Wardle, J., & Watts, C. J. (1998). Fruit and vegetable consumption, nutritional knowledge and beliefs in mothers and children. *Appetite, 31*(2), 205-228. doi: 10.1006/appe.1998.0180

Gillison, F. B., Osborn, M., Standage, M., & Skevington, S. M. (2009). Exploring the experience of introjected regulation for exercise across gender in adolescence. *Psychology of Sport and Exercise, 10*(3), 309-319. doi: 10.1016/j.psychsport.2008.10.004

Gillison, F. B., Standage, M., & Skevington, S. M. (2006). Relationships among adolescents' weight perceptions, exercise goals, exercise motivation, quality of life and leisure-time exercise behaviour: a self-determination theory approach. *Health Education Research, 21*, 836-847. doi: 10.1093/her/cyl139

Gillison, F. B., Standage, M., & Skevington, S. M. (2011). Motivation and body-related factors as discriminators of change in adolescents' exercise behavior profiles. *Journal of Adolescent Health, 48*, 44-51. doi: 10.1016/j.jadohealth.2010.05.006

Gillison, F. B., Standage, M., & Skevington, S. M. (2013). The effects of manipulating goal content and autonomy support climate on outcomes of a PE fitness class. *Psychology of Sport and Exercise, 14*(3), 342-352. doi: 10.1016/j.psychsport.2012.11.011

Glasgow, R. E., Toobert, D. J., & Hampson, S. E. (1996). Effects of a brief office-based intervention to facilitate diabetes dietary self-management. *Diabetes Care, 19*(8), 835-842.

Goldberg, H. I., Lessler, D. S., Mertens, K., Eytan, T. A., & Cheadle, A. D. (2004). Self-management support in a web-based medical record: a pilot randomized controlled trial. *Journal on Quality and Safety, 30*, 629-635.

Golley, R. K. (2005). *Family-focused management of overweight in pre-pubertal children - a randomised controlled trial. The healthy eating and lifestyle through positive parenting (HELPP) study.* Flinders University.

Golley, R. K., Magarey, A. M., Baur, L. A., Steinbeck, K. S., & Daniels, L. A. (2007). Twelve-month effectiveness of a parent-led, family-focused weight-management program for prepubertal children: A randomized, controlled trial. *Pediatrics, 119*(3), 517-525. doi: 10.1542/peds.2006-1746

Golley, R. K., Perry, R. A., Magarey, A., & Daniels, L. (2007). Family-focused weight management program for five- to nine-year-olds incorporating parenting skills training with healthy lifestyle information to support behaviour modification. *Nutrition & Dietetics, 64*(3), 144-150. doi: 10.1111/j.1747-0080.2007.00106.x

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38*, 69-119. doi: 10.1016/S0065-2601(06)38002-1

Goudas, M., Ardamerinos, N., Vasilliou, S., & Zanou, S. (1999). Effect of gol-setting on reaction time. *Perceptual and Motor Skills, 89*(3), 849-852. doi: 10.2466/pms.1999.89.3.849

Gourlan, M., Trouilloud, D., & Sarrazin, P. (2013). Motivational characteristics of obese adolescents toward physical activity: Contribution of self-determination theory. *Revue Européenne de Psychologie Appliquée/European Review of Applied Psychology*(0). doi: 10.1016/j.erap.2013.02.001

Gratton, L., Povey, R., & Clark-Carter, D. (2007). Promoting children's fruit and vegetable consumption: Interventions using the Theory of Planned Behaviour as a framework. *British Journal of Health Psychology, 12*(4), 639-650. doi: 10.1348/135910706x171504

Greaves, C. J., Sheppard, K. E., Abraham, C., Hardeman, W., Roden, M., Evans, P. H., . . . The IMAGE Study Group. (2011). Systematic review of reviews of intervention components associated with increased effectiveness in dietary and physical activity interventions. *BMC Public Health, 11*, 119.

Griffiths, L. J., Parson, T. J., & Hill, A. J. (2010). Self-esteem and quality of life in obese children and adolescents: a systematic review. *International Journal of Pediatric Obesity, 5*(4), 282-304. doi: 10.3109/17477160903473697

Grolnick, W. S., Deci, E. L., & Ryan, R. M. (1997). Internalization within the family: The self-determination theory perspective. In J. E. Grusec & L. Kuczynski (Eds.), *Parenting and children's internalization of values: A handbook of contemporary theory* (pp. 135-161). New York: Wiley.

Grolnick, W. S., Frodi, A., & Bridges, L. (1984). Maternal control style and the mastery motivation of one-year-olds. *Infant Mental Health Journal, 5*(2), 72-82. doi: 10.1002/1097-0355(198422)5:2<72::aid-imhj2280050203>3.0.co;2-o

Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-regulation and competence in school. *Journal of Educational Psychology 81*(2), 143-154.

Hagger, M. S., & Chatzisarantis, N. L. D. (2009). Integrating the theory of planned behaviour and self-determination theory in health behaviour: A meta-analysis. *British Journal of Health Psychology, 14*(2), 275-302.

Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, C. K. J., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: A cross-cultural evaluation of the trans-contextual model. *Journal of Educational Psychology, 97*(3), 376-390. doi: 10.1037/0022-0663.97.3.376

Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. (2002). The influence of autonomous and controlling motives in physical activity intentions within the Theory of Planned Behaviour. *British Journal of Health Psychology, 7*, 283-297.

Hagger, M. S., Chatzisarantis, N. L. D., Culverhouse, T., & Biddle, S. J. H. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: A trans-contextual model. *Journal of Educational Psychology, 95*(4), 784-795. doi: 10.1037/0022-0663.95.4.784

Hagger, M. S., Chatzisarantis, N. L. D., & Harris, J. (2006a). From psychological need satisfaction to intentional behavior: Testing a motivational sequence in two behavioral contexts. *Personality and Social Psychology Bulletin, 32*(2), 131-148. doi: 10.1177/0146167205279905

Hagger, M. S., Chatzisarantis, N. L. D., & Harris, J. (2006b). The process by which relative autonomous motivation affects intentional behavior: Comparing effects across dieting and exercise behaviors. *Motivation and Emotion, 30*, 307-321. doi: 10.1007/s11031-006-9046-5

Hagger, M. S., Chatzisarantis, N. L. D., Hein, V., Pihu, M., Soós, I., & Karsai, I. (2007). The perceived autonomy support scale for exercise settings (PASSES): Development, validity, and cross-cultural invariance in young people. *Psychology of Sport and Exercise, 8*(5), 632-653. doi: 10.1016/j.psychsport.2006.09.001

Hagger, M. S., Chatzisarantis, N. L. D., Hein, V., Soos, I., Karsai, I., Lintunen, T., & Leemans, S. (2009). Teacher, peer and parent autonomy support in physical education and leisure-time physical activity: A trans-contextual model of motivation in four nations. *Psychology & Health, 24*(6), 689-711. doi: 10.1080/08870440801956192

Hagger, M. S., Keatley, D. A., Chan, D. K. C., Chatzisarantis, N. L. D., Dimmock, J. A., Jackson, B. J., & Ntoumanis, N. (2013). The goose is (half) cooked: A consideration of the mechanisms and interpersonal context is needed to elucidate the effects of personal financial incentives on health behaviour. *International Journal of Behavioral Medicine*. doi: 10.1007/s12529-013-9317-y

Haines, J., Neumark-Sztainer, D., Hannan, P. J., & Robinson-O'Brien, R. (2008). Child versus parent report of parental influences on children's weight-related attitudes and behaviors. *Journal of Pediatric Psychology, 33*(7), 783-788. doi: 10.1093/jpepsy/jsn016

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139-151. doi: 10.2753/MTP1069-6679190202

Hall, K. S., Crowley, G. M., Bosworth, H. B., Howard, T. A., & Morey, M. C. (2010). Individual progress toward self-selected goals among older adults enrolled in a physical activity counseling intervention. *Journal of Aging and Phyiscal Activity, 18*, 439-450.

Hammer, L. (2003). Weight control in children and adolescents proves successful in a family-based program. *The Permanete Journal, 7*(2), 40-41.

Handley, M., MacGregor, K., Schillinger, D., Sharifi, C., Wong, S., & Bodenheimer, T. (2006). Using action plans to help primary care patients adopt healthy behaviors. *J Amer Board Fam Med, 19*, 224-231.

Hands, B., Parker, H., Glasson, C., Brinkman, S., & Read, H. (2004). Physical Activity and Nutrition Levels in Western Australian Children and Adolescents. Perth: Western Australian Government.

Hanson, N. I., Neumark-Sztainer, D., Eisenberg, M. E., Story, M., & Wall, M. (2005). Associations between parental report of the home food environment and adolescent intakes of fruits, vegetables and dairy foods. *Public Health Nutrition, 8*(1), 77-85. doi: 10.1079/PHN2004661

Hare, M., Sherrill-Mittleman, D., Klesges, R. C., Lanctot, J. Q., & Klesges, L. M. (2012). Energy underreporting in African-American girls: A longitudinal analysis. *Childhood Obesity, 8*(6), 551-560. doi: 10.1089/chi.2011.0117

Harris, J., & Standage, H. (2014). The effect of autonomous and controlled motives on eating dysregulation: Implications for individuals classified as underweight, overweight or obese. *Revue Européenne de Psychologie Appliquée/European Review of Applied Psychology, 64*(2), 43-51. doi: 10.1016/j.erap.2013.12.001

Harvey-Berino, J., & Rourke, J. (2003). Obesity prevention in preschool Native-American children: A pilot study using home visiting. *Obesity Research, 11*(5), 606-611. doi: 10.1038/oby.2003.87

Hausenblas, H. A., Hall, C., Rodgers, W. M., & Munroe, K. J. (1999). Exercise imagery: Its nature and measurement. *Journal of Applied Sport Psychology, 11*, 171-180.

Hein, V., & Koka, A. (2007). Perceived feedback and motivation in physical education and physical activity. In M. S. Hagger & N. L. D. Chatzisarantis (Eds.), *Intrinsic motivation and self-determinatino in exercise and sport*. Chapaign, Illinois, United States: Human Kinetics.

Heisler, M., Bouknight, R. R., Hayward, R. A., Smith, D. M., & Kerr, E. A. (2002). The relative importance of physician communication, participatory decision making, and patient understanding in diabetes self-management. *Journal of General Internal Medicine, 17*(4), 243-252.

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. *New Challenges to International Marketing: Advances in International Marketing, 20*, 277-319. doi: 10.1108/S1474-7979(2009)0000020014

Herbert, J. R., Clemow, L., Pbert, L., Ockene, I. S., & Ockene, J. K. (1995). Social desirability bias in dietary self-report may compromise the validity of dietary intake measures. *International Journal of Epidemiology, 24*(2), 389-398. doi: 10.1093/ije/24.2.389

Hester, J. R., McKenna, J., & Gately, P. J. (2010). Obese young people's accounts of intervention impact. *Patient Education and Counseling, 79*(3), 306-314. doi: 10.1016/j.pec.2009.11.005

Hirvensalo, M., & Lintunen, T. (2011). Life-course perspective for physical activity and sports participation. *Eur Rev Aging Phys Act, 8*, 13-22. doi: 10.1007/s11556-010-0076-3

Hodgins, H. S., Yacko, H. A., & Gottlieb, E. (2006). Autonomy and nondefensiveness. *Motivation and Emotion, 30*(4), 283-293. doi: 10.1007/s11031-006-9036-7

Hoelter, J. W. (1983). The analysis of covariance structures: Goodness-of-fit indices. *Sociological Methods & Research, 11*(3), 325-344. doi: 10.1177/0049124183011003003

Holsten, J. E., Deatrick, J. A., Kumanyika, S., Pinto-Martin, J., & Compher, C. W. (2012). Children's food choice process in the home environment. A qualitative descriptive study. *Appetite, 58*(1), 64-73. doi: 10.1016/j.appet.2011.09.002

Huang, J. S., Norman, G. J., Zabinski, M., Calfas, K., & Patrick, K. (2007). Body image and self-esteem among adolescents undergoing an intervention targeting dietary and physical activity behaviors. *Journal of Adolescent Health, 40*(3), 245-251. doi: 10.1016/j.jadohealth.2006.09.026

Ingledew, D. K., & Markland, D. (2008). The role of motives in exercise participation. *Psychology & Health, 23*(7), 807-828. doi: 10.1080/08870440701405704

Israel, A. C., Guile, C. A., Baker, J. E., & Silverman, W. K. (1994). An evaluation of enhanced self-regulation training in the treatment of childhood obesity. *Journal of Pediatric Psychology, 19*(6), 737-749. doi: 10.1093/jpepsy/19.6.737

Ivancevich, J. M. (1976). Effects of goal setting on performance and job satisfaction. *Journal of Applied Psychology, 61*(5), 605-612.

Jago, R., Sebire, S. J., Turner, K. M., Bentley, G. F., Goodred, J. K., Fox, K. R., . . . Lucas, P. J. (2013). Feasibility trial evaluation of a physical activity and screen-viewing course for parents of 6 to 8 year-old children: Teamplay. *International Journal of Behavioral Nutrition and Physical Activity, 10*(31). doi: 10.1186/1479-5868-10-31

Janicke, D. M., Gray, W. N., Mathews, A. E., Simon, S. L., Lim, C. S., Dumont-Driscoll, M., & Silverstein, J. H. (2011). A pilot study examining a group-based behavioral family intervention for obese children enrolled in Medicaid: Differential outcomes by race. *Children's Health Care, 40*(3), 212-231. doi: 10.1080/02739615.2011.590394

Janicke, D. M., Sallinen, B. J., Perri, M. G., Lutes, L. D., Huerta, M. G., Silverstein, J. H., & Brumback, B. (2008). Comparison of parent-only vs family-based interventions for overweight children in underserved rural settings: Outcomes from project STORY. *Archives of Pediatrics & Adolescent Medicine, 162*(12), 1119-1125. doi: 10.1001/archpedi.162.12.1119

Janssen, I., Katzmarzyk, P. T., Boyce, W. F., Vereecken, C., Mulvihill, C., Roberts, C., . . . Pickett, W. (2005). Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary pattersn. *Obesity Reviews, 6*, 123-132.

Jones, G., & Cale, A. (1997). Goal difficulty, anxiety and performance. *Ergonomics, 40*(3), 319-333. doi: 10.1080/001401397188170

Jung, M. E., & Brawley, L. R. (2010). Concurrent management of exercise with other valued life goals: Comparison of frequent and less frequent exercisers. *Psychology of Sport and Exercise, 11*(5), 372-377. doi: DOI: 10.1016/j.psychsport.2010.04.006

Kant, A. K. (2003). Interaction of body mass index and attempt to lose weight in a national sample of US adults: association with reported food and nutrient intake, and biomarkers. *European Journal of Clinical Nutrition, 57*(2), 249-259. doi: 10.1038/sj.ejcn.1601549

Karfopoulou, E., Mouliou, K., Koutras, Y., & Yannakoulia, M. (2013). Behaviours associated with weight loss maintenance and regaining in a Mediterranean population sample. A qualitative study. *Clinical Obesity, 3*(5), 141-149. doi: 10.1111/cob.12028

Karimi-Shahanjarini, A., Rashidian, A., Majdzadeh, R., Omidvar, N., Tabatabai, M. G., & Shojaeezadeh, D. (2012). Parental control and junk-food consumption: A mediating and moderating effect analysis. *Journal of Applied Psychology, 42*(5), 1241-1265. doi: 10.1111/j.1559-1816.2011.00885.x

Kasser, T. (2002a). *The high price of materialism*. Cambridge, MA: MIT Press.

Kasser, T. (2002b). Sketches for a self-determination theory of values. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 123-140). Rochester, NY: University of Rochester Press.

Kasser, T., & Ryan, R. M. (1993). A dark side of the American dream: Correlates of financial success as a central life aspiration. *Journal of Personality and Social Psychology, 65*(2), 410-422. doi: 10.1037/0022-3514.65.2.410

Kasser, T., & Ryan, R. M. (1996). Further examining the american dream: Differential correlates of intrinsic and extrinsic goals. *Personality and Social Psychology Bulletin, 22*(3), 80-87.

Kasser, T., & Ryan, R. M. (2001). Be careful what you wish for: Optimal functioning and the relative attainment of intrinsic and extrinsic goals. In P. Schmuck & K. Sheldon (Eds.), *Life goals and well-being: Towards a positive psychology of human striving* (pp. 116-131). Goettingen, Germany: Hogrefe & Huber.

Kasser, T., Ryan, R. M., Couchman, C. E., & Sheldon, K. M. (2004). Materialistic values: Their causes and consequences. In T. Kasser & A. D. Kanner (Eds.), *Psychology and consumer culture: The struggle for a good life in a materialistic world* (pp. 11-28). Washington, DC: American Psychological Association.

Kellar, I., & Abraham, C. (2005). Randomized controlled trial of a brief research-based intervention promoting fruit and vegetable consumption. *British Journal of Health Psychology, 10*(4), 543-558. doi: 10.1348/135910705x42940

Kitzman-Ulrich, H., Wilson, D. K., St. George, S. M., Segal, M., Schneider, E., & Kugler, K. (2011). A preliminary test of a motivational and parenting weight loss program targeting low-income and minority adolescents. *Childhood Obesity, 7*(5), 379-384. doi: 10.1089/chi.2011.0030

Klein, H. J., Wesson, M. J., Hollenbeck, J. R., & Alge, B. J. (1999). Goal commitment and the goal-setting process: conceptual clarification and empirical synthesis. *Journal of Applied Psychology, 84*, 885-896.

Klein, H. J., Wesson, M. J., Hollenbeck, J. R., Wright, P. M., & DeShon, R. P. (2001). The assessment of goal commitment: A measurement model meta-analysis. *Organizational Behavior and Human Decision Processes, 85*(1), 32-55. doi: 10.1006/obhd.2000.2931

Koestner, R. (1996). Identified and introjected forms of political internalization: Extending self-determination theory. *Journal of Personality and Social Psychology, 70*(5), 1025.

Koestner, R., Lekes, N., Powers, T. A., & Chicoine, E. (2002). Attaining personal goals: Self-concordance plus implementation intentions equals success. *Journal of Personality and Social Psychology, 83*(1), 231-244. doi: 10.1037//0022-3514.83.1.231

Koestner, R., Otis, N., Powers, T. A., Pelletier, L., & Gagnon, H. (2008). Autonomous motivation, controlled motivation, and goal progress. *Journal of Personality, 76*(5), 1201-1230. doi: 10.1111/j.1467-6494.2008.00519.x

Koka, A. (2013a). The effect of teacher and peers need support on students' motivation in physical education and its relationship to leisure time physical activity. *Acta Kinesiologiae Universitatis Tartuensis, 19*, 48-62. doi: 10.12697/akut.2013.19.05

Koka, A. (2013b). The relationships between perceived teaching behaviors and motivation in physical education: A one-year longitudinal study. *Scandinavian Journal of Educational Research, 57*(1), 33-53. doi: 10.1080/00313831.2011.621213

Konttinen, H., Sarlio-Lähteenkorva, S., Silventoinen, K., Männistö, S., & Haukkala, A. (2013). Socio-economic disparities in the consumption of vegetables, fruit and energy-dense foods: the role of motive priorities. *Public Health Nutrition, 16*(05), 873-882. doi: doi:10.1017/S1368980012003540

Koulouglioti, C., Cole, R., McQuillan, B., Moskow, M., Kueppers, J., & Pigeon, W. (2013). Feasibility of an individualized, home-based obesity prevention program for preschool-age children. *Children's Health Care, 42*(2), 134-152. doi: 10.1080/02739615.2013.766099

Kuczmarski, R. J., Ogden, C. L., Grummer-Strawn, L. M., Flegal, K. M., Guo, S. S., Wei, R., . . . Johnson, C. L. (2000). CDC growth charts: United States. *Advance Data, 314*, 1-27.

Kyllo, L. B., & Landers, D. M. (1995). Goal setting in sport and exercise: a research synthesis to resolve the controversy. *Journal of Sport & Exercise Psychology, 17*, 117-137.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorial data. *Biometrics, 33*, 159-174.

LaRowe, T. L., Wubben, D. P., Cronin, K. A., Vannatter, S. M., & Adams, A. K. (2007). Development of a culturally appropriate, home-based nutrition and physical activity curriculum for Wisconsin American Indian families. *Preventing Chronic Disease, 4*(4).

Larson, N. I., Neumark-Sztainer, D., Hannan, P. J., & Story, M. (2007). Family meals during adolescence are associated with higher diet quality and healthful meal patterns during young adulthood. *Journal of the American Dietetic Association, 107*(9), 1502-1510.

Larson, N. I., Neumark-Sztainer, D. R., Story, M. T., Wall, M. M., Harnack, L. J., & Eisenberg, M. E. (2008). Fast food intake: longitudinal trends during the transition to young adulthood and correlates of intake. *Journal of Adolescent Health, 43*(1), 79-86. doi: 10.1016/j.jadohealth.2007.12.005

Latif, H., Watson, K., Nguyen, N., Thompson, D., Baranowski, J., Jago, R., . . . Baranowski, T. (2011). Effects of goal setting on dietary and physical activity changes in the boy scout badge projects. *Health Education & Behavior*. doi: 10.1177/1090198110385774

Lawlor, D. A., Benfield, L., Logue, J., Tilling, K., Howe, l. D., Fraser, A., . . . Sattar, N. (2010). Association between general and central adiposity in childhood, and change in these, with cardiovascular risk factors in adolescence: Prospective cohort study. *BMJ, 341*, c6224. doi: 10.1136/bmj.c6224

Lens, W., Paixão, M. P., Herrera, D., & Grobler, A. (2012). Future time perspective as a motivational variable: Content and extension of future goals affect the quantity and quality of motivation. *Japanese Psychological Research, 54*(3), 321-333. doi: 10.1111/j.1468-5884.2012.00520.x

Leong, S. L., Madden, C., Gray, A., & Horwarth, C. (2012). Self-determined, autonomous regulation of eating behavior is related to lower body mass index in a nationwide survey of middle-aged women. *Journal of Academy of Nutrition and Dietetics, 112*(9), 1337-1346. doi: 10.1016/j.jand.2012.04.018

Lerner, B. S., & Locke, E. A. (1995). The effect of goal setting, self-efficacy, competition, and personal trials on the performance of an endurance task. *Journal of Sport & Exercise Psychology, 17*(2), 138-152.

Levesque, C., Copeland, K. J., & Sutcliffe, R. A. (2008). Conscious and nonconscious processes: Implications for self-determination theory. *Canadian Psychology, 49*(3), 218-224.

Lim, B. S. C., & Wang, C. K. J. (2009). Perceived autonomy support, behavioural regulations in physical education and physical activity intention. *Psychology of Sport and Exercise, 10*, 52-60. doi: 10.1016/j.psychsport.2008.06.003

Lindelof, A., Nielsen, C. V., & Pedersen, B. D. (2010). Obesity treatment–more than food and exercise: a qualitative study exploring obese adolescents' and their parents' views of the former's obesity *Int J Qual Stud Health Well-being, 5*(2), 5073. doi: 10.3402/qhw.v5i2.5073

Lindelof, A., Nielsen, C. V., & Pedersen, B. D. (2011). Obesity stigma at home: A qualitative, longitudinal study of obese adolescents and their parents. *Childhood Obesity, 7*(6), 462-474.

Lindsay, A. C., Sussner, K. M., Kim, J., & Gortmaker, S. L. (2006). The role of parents in preventing childhood obesity. *The Future of Children, 16*(1), 169-185. doi: 10.1353/foc.2006.0006

Lioret, S., Touvier, M., Balin, M., Huybrechts, I., Dubuisson, C., Dufour, A., . . . Lafay, L. (2011). Characteristics of energy under-reporting in children and adolescents. *British Journal of Nutrition, 105*(11), 1671-1680. doi: 10.1017/S0007114510005465

Livingstone, M. B. E., & Black, A. E. (2003). Markers of the validity of reported energy intake. *Journal of Nutrition, 133*(3), 895-920.

Livingstone, M. B. E., & Robson, P. J. (2000). Measurement of dietary intake in children. *Proceedings of the Nutrition Society, 59*(2), 279-293.

Livingstone, M. B. E., Robson, P. J., & Wallace, J. M. W. (2004). Issues in dietary intake assessment of children and adolescents. *The British Journal of Nutrition, 92* (Suppl 2), S213-S222.

Locke, E. A. (1968). Toward a theory of task motivation and incentives. *Organizational Behavior and Human Performance, 3*, 157-189.

Locke, E. A., & Bryan, J. F. (1969). The directing function of goals in task performance. *Organizational Behavior and Human Performance, 4*(1), 35-42. doi: 10.1016/0030-5073(69)90030-0

Locke, E. A., Cartledge, N., & Koeppel, J. (1968). Motivational effects of knowledge of results: A goal-setting phenomenon. *Psychological Bulletin, 70*(6), 474-485.

Locke, E. A., Chah, D. O., Harrison, S., & Lustgarten, N. (1989). Separating the effects of goal specificity from goal level. *Organizational Behavior and Human Decision Processes, 43*(2), 270-287. doi: Doi: 10.1016/0749-5978(89)90053-8

Locke, E. A., & Latham, G. P. (1985). The application of goal setting in sports. *Journal of Sport Psychology, 7*(3), 205-222.

Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting and task performance*. Englewood Cliffs, New Jersey: Prentice Hall.

Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist, 57*(9), 705-717. doi: 10.1037/0003-066x.57.9.705

Locke, E. A., & Latham, G. P. (2013). Goal setting theory, 1990. In E. A. Locke & G. P. Latham (Eds.), *New developments in goal setting and task performance* (pp. 3-15). New York: Routledge.

Locke, E. A., Shaw, K. N., Saari, L. M., & Latham, G. P. (1981). Goal setting and task performance 1969-1980. *Psychological Bulletin, 90*(1), 125-152.

Loth, K. A., MacLehose, R. F., Fulkerson, J. A., Crow, S., & Neumark-Sztainer, D. (2013). Food-related parenting practices and adolescent weight status: A population-based study. *Pediatrics, 131*(5), e1443-e1450. doi: 10.1542/peds.2012-3073

Lundell, L. J., Grusec, J. E., McShane, K. E., & Davidov, M. (2008). Mother-adolescent conflict: Adolescent goals, maternal perspective-taking, and conflict intensity. *Journal of Research on Adolescence, 18*(3), 555-571.

Luppino, F., de Wit, L. M., Bouvy, P. F., Stinjnen, T., Cuipers, P., Penninx, B., & Zitman, G. G. (2010). Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. *Archives of General Psychiatry, 67*(3), 220-229. doi: 10.1001/archgenpsychiatry.2010.2

Madsen, K. A., McCulloch, C. E., & Crawford, P. B. (2009). Parent modeling: perceptions of parents' physical activity predict girls' activity throughout adolescence. *The Journal of Pediatrics, 154*(2), 278-283.e272. doi: 10.1016/j.jpeds.2008.07.044

Maes, S., & Karoly, P. (2005). Self-Regulation Assessment and Intervention in Physical Health and Illness: A Review. *Applied Psychology: An International Review, 54*(2), 267-299. doi: 10.1111/j.1464-0597.2005.00210.x

Magarey, A., Watson, J., Golley, R. K., Burrows, T., Sutherland, R., McNaughton, S. A., . . . Collins, C. (2011). Assessing dietary intake in children and adolescents: Considerations and recommendations for obesity research. *International Journal of Pediatric Obesity, 6*(1), 2-11.

Maltby, J., & Day, L. (2001). The relationship between exercise motives and psychological well-being. *Journal of Psychology, 135*(6), 651-660.

Mandigo, J., Holt, N., Anderson, A., & Sheppard, J. (2008). Children's motivational experiences following autonomy-supportive games lessons. *European Physical Education Review, 14*(3), 407-425. doi: 10.1177/1356336x08095673

Markland, D., & Ingledew, D. K. (2007). The relationships between body mass and body image and relative autonomy for exercise among adolescent males and females. *Psychology of Sport and Exercise, 8*(5), 836-853. doi: 10.1016/j.psychsport.2006.11.002

Markland, D., & Tobin, V. J. (2004a). *Further evidence for the mediating role of psychological need satisfaction between social-contextual supports and intrinsic motivation: A comparison of competing models*. Unpublished manuscript.

Markland, D., & Tobin, V. J. (2004b). A modification of the behavioral regulation in exercise questionnaire to include an assessment of amotivation. *Journal of Sport & Exercise Psychology, 26*, 191-196.

Mata, J., Silva, M. N., Vieira, P. N., Carraça, E. V., Andrade, A. M., Coutinho, S. R., . . . Teixeira, P. J. (2009). Motivational "spill-over" during weight control: Increased self-determination and exercise intrinsic motivation predict eating self-regulation. *Health Psychology, 28*(6), 709-716. doi: 10.1037/a0016764

McGovern, L., Johnson, J. N., Paulo, R., Hettinger, A., Singhal, V., Kamath, C., . . . Montori, V. M. (2008). Treatment of pediatric obesity: A systematic review and meta-analysis of randomized trials. *Journal of Clinical Endocrinology & Metabolism, 93*(12), 4600-4605. doi: 10.1210/jc.2006-2409

McKenzie, T. (2001). Promoting physical activity in youth: Focus on middle school environments. *Quest, 326-334*.

McKenzie, T., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Student activity levels, lesson context, and teacher behavior during middle school physical education. *Research Quarterly for Exercise and Sport, 71*(3), 249-259.

McLachlan, S., & Hagger, M. S. (2010a). Associations between motivational orientations and chronically accessible outcomes in leisure-time physical activity. *Research Quarterly for Exercise and Sport, 81*(1), 102-107. doi: 10.1080/02701367.2010.10599633

McLachlan, S., & Hagger, M. S. (2010b). Effects of an autonomy-supportive intervention on tutor behaviors in a higher education context. *Teaching and Teacher Education, 26*, 1204-1210. doi: 10.1016/j.tate.2010.01.006

McLachlan, S., & Hagger, M. S. (2011). Do people differentiate between intrinsic and extrinsic goals for physical activity? *Journal of Sport & Exercise Psychology, 33*, 273-288.

McLachlan, S., Spray, C., & Hagger, M. S. (2011). The development of a scale measuring integrated regulation in exercise. *British Journal of Health Psychology, 16*(4), 722-743. doi: 10.1348/2044-8287.002009

McManus, K., Antinoro, L., & Sacks, F. (2001). A randomized controlled trial of a moderate-fat, low-energy diet compared with a low fat, low-energy diet for weight loss in overweeight adults. *International Journal of Obesity, 25*, 1503-1511.

McMurray, R. G., Ward, D. S., Elder, J. P., Lytle, L. A., Strikmiller, P. K., Baggett, C. D., & Young, D. R. (2008). Do overweight girls overreport physical activity? *Am J Health Behav., 32*(5), 538-546. doi: 10.5555/ajhb.2008.32.5.538

Melanson, K. J. (2009). Dietary considerations for the prevention and treatment of obesity in youth. *American Journal of Lifestyle Medicine, 3*(2), 106-109. doi: 10.1177/1559827608329221

Mendonca, P. J., & Brehm, S. S. (1983). Effects of choice on behavioral treatment of overweight children. *Journal of Social and Clinical Psychology, 1*(4), 343-358. doi: 10.1521/jscp.1983.1.4.343

Mento, A. J., Cartledge, N. D., & Locke, E. A. (1980). Maryland vs Michigan vs Minnesota: Another look at the relationship of expectancy and goal difficulty to task performance. *Organizational Behavior and Human Performance, 25*(3), 419-440. doi: 10.1016/0030-5073(80)90038-0

Metcalf, B., Henley, W., & Wilkin, T. (2012). Effectiveness of intervention on physical activity of children: systematic review and meta-analysis of controlled trials with objectively measured outcomes (EarlyBird 54). *BMJ, 345*, e5888. doi: 10.1136/bmj.e5888

Michie, S., Abraham, C., Whittington, C., McAteer, J., & Gupta, S. (2009). Effective techniques in healthy eating and physical activity interventions: A meta-regression. *Health Psychology, 28*(6), 690-701. doi: 10.1037/a0016136

Moller, A. C., McFadden, H. G., Hedeker, D., & Spring, B. (2012). Financial motivation undermines maintenance in an intensive diet and activity intervention. *Journal of Obesity, 2012*, 1-8. doi: 10.1155/2012/740519

Moreno-Murcia, J. A., González-Cutre Coll, D., Martín-Albo, J., & Cervelló, E. (2010). Motivation and performance in physical education: An experimental test. *Journal of Sports Science and Medicine, 9*, 79-85.

Moreno-Murcia, J. A., Lacárcel, J. A. V., & Álvarez, F. D. (2010). Search for autonomy in motor task learning in physical education university students. *European Journal of Psychology of Education, 25*(1), 37-47. doi: 10.1007/s10212-009-0008-7

Morgan, A., Keiley, M. K., Ryan, A. E., Radomski, J. G., Gropper, S. S., Connell, L. J., . . . Ulrich, P. V. (2012). Eating regulation styles, apperance schemas, and body satisfaction predict changes in body fat for emerging adults. *Journal of Youth and Adolescence, 41*, 1127-1141. doi: 10.1007/s10964-012-9757-8

Morrison, S., Dashiff, C. J., & Vance, D. E. (2013). Role of parental autonomy support on self-determination in influencing diet and exercise motivation in older adolescents. *Nursing: Research and Reviews, 3*, 77-85. doi: 10.2147/NRR.S43795

Mouratidis, A., Vansteenkiste, M., Lens, W., & Sideridis, G. (2008). The motivating role of positive feedback in sport and physical education: Evidence for a motivational model. *Journal of Sport & Exercise Psychology, 30*, 240-268.

Mullan, E., Markland, D., & Ingledew, D. K. (1997). A graded conceptualisation of self-determination in the regulation of exercise behaviour: Development of a measure using confirmatory factor analytic procedures. *Personality and Individual Differences, 23*(5), 745-752.

Munroe-Chandler, K. J., Hall, C. R., & Weinberg, R. (2004). A qualitative analysis of the types of goals athletes set in training and competition. *ProQuest Central, 27*(1), 58-74.

Murcia, J. A. M., González-Cutre, D. C., & Pérez, L. M. R. (2009). Self-determined motivation and physical education importance. *Human Movement, 10*(1), 5-11.

Ng, J. Y. Y., Ntoumanis, N., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts: A meta-analysis. *Perspectives on Psychological Science, 7*(4), 325-340. doi: 10.1177/1745691612447309

Niemiec, C. P., Lynch, M. F., Vansteenkiste, M., Bernstein, J., Deci, E. L., & Ryan, R. M. (2006). The antecedents and consequences of autonomous self-regulation for college: A self-determination theory perspective on socialization. *Journal of Adolescence, 29*(5), 761-775. doi: 10.1016/j.adolescence.2005.11.009

Niemiec, C. P., Ryan, R. M., & Deci, E. L. (2009). The path taken: Consequences of attaining intrinsic and extrinsic aspirations in post-college life. *Journal of Research in Personality, 43*(3), 291-306. doi: 10.1016/j.jrp.2008.09.001

Nothwehr, F., & Yang, J. (2007). Goal setting frequency and the use of behavioral strategies related to diet and physical activity. *Health Education Research, 22*(4), 532-538. doi: 10.1093/her/cyl117

Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology, 71*(2), 225-242. doi: 10.1348/000709901158497

Ntoumanis, N. (2005). A prospective study of participation in optional school physical education using a self-determination theory framework. *Journal of Educational Psychology, 97*(3), 444-453.

Ntoumanis, N. (2012). A review of self-determination theory in sport and physical education. In G. C. Roberts & D. C. Treasure (Eds.), *Advances in motivation in sport and exercise* (3rd ed., pp. 91-128). Champaign, IL: Human Kinetics.

Ntoumanis, N., Healy, L. C., Sedikides, C., Duda, J. L., Stewart, B., Smith, A. L., & Bond, J. (2013). When the going gets tough: The "why" of goal striving matters. *Journal of Personality*. doi: 10.1111/jopy.12047

Ntoumanis, N., Pensgaard, A. M., Martin, C., & Pipe, K. (2004). An idiographic analysis of amotivation in compulsory school physical education. *Journal of Sport & Exercise Psychology, 26*, 187-214.

Ntoumanis, N., & Standage, M. (2009). Motivation in physical education classes: A self-determination theory perspective. *Theory and Research in Education, 7*(2), 194-202. doi: 10.1177/1477878509104324

O'Connor, T. M., Hilmers, A., Watson, K., Baranowski, T., & Giardino, A. P. (2011). Feasibility of an obesity intervention for paediatric primary care targeting parenting and children: Helping HAND. *Child: Care, Health and Development, 39*(1), 141-149. doi: 10.1111/j.1365-2214.2011.01344.x

Olds, T. S., Maher, C., Zumin, S., Peneau, S., Lioret, S., Castetbon, K., . . . Summerbell, C. (2011). Evidence that the prevalence of childhood overweight is plateauing: data from nine countries. *International Journal of Pediatric Obesity, 6*, 342-360. doi: 10.3109/17477166.2011.605895

Olds, T. S., Tomkinson, G. R., Ferrar, K. E., & Maher, C. A. (2009). Trends in the prevalence of childhood overweight and obesity in Australia between 1985 and 2008. *International Journal of Obesity, 34*(1), 57-66. doi: 10.1038/ijo.2009.211

Ornelas, I. J., Perreira, K. M., & Ayala, G. X. (2007). Parental influences on adolescent physical activity: A longitudinal study. *International Journal of Behavioral Nutrition and Physical Activity, 4*(3). doi: 10.1186/1479-5868-4-3

Oude Luttikhuis, H., Baur, L. A., Jansen, H., Shrewsbury, V. A., O'Malley, C. O., Stolk, R. P., & Summerbell, C. D. (2009). Interventions for treating obesity in children (Review): The Cochrane Collaboration.

Owen, K. B., Astell-Burt, T., & Lonsdale, C. (2013). The relationship between self-determined motivation and physical activity in adolescent boys. *Journal of Adolescent Health, 53*(3), 420-422. doi: 10.1016/j.jadohealth.2013.05.007

Parks-Stamm, E. J., Gollwitzer, P. M., & Oettingen, G. (2007). Action control by implementation intentions: Effective cue detection and efficient response initiation *Social Cognition, 25*(2), 248-266.

Pash, K. E., Nelson, M. C., Lytle, L. A., Moe, S. G., & Perry, C. L. (2008). The adoption of risk-related factors through early adolescence: associations with weight status and implications for casual mechanisms. *Journal of Adolescent Health, 43*(4), 387-393.

Patrick, H., Neighbors, C., & Knee, C. R. (2004). Appearance-related social comparisons: The role of contingent self-esteem and self-perceptions of attractiveness. *Personality & social psychology bulletin, 30*(4), 501.

Pearson, E. S. (2012). Goal setting as a health behavior change strategy in overweight and obese adults: A systematic literature review examining intervention components. *Patient Education and Counseling, 87*(1), 32-42. doi: 10.1016/j.pec.2011.07.018

Pearson, N., Biddle, S. J. H., & Gorely, T. (2009). Family correlates of fruit and vegetable consumption in children and adolescents: a systematic review. *Public Health Nutrition, 12*(02), 267-283. doi: doi:10.1017/S1368980008002589

Pearson, N., Biddle, S. J. H., Williams, L., Worsley, A., Crawford, D., & Ball, K. (2012). Adolescent television viewing and unhealthy snack food consumption: the mediating role of home availability of unhealthy snack foods. *Public Health Nutrition, FirstView*, 1-7. doi: doi:10.1017/S1368980012005204

Pelletier, L. G., Dion, S. C., Slovinec-D'Angelo, M., & Reid, R. (2004). Why do you regulate what you eat? Relationships between forms of regulation, eating behaviors, sustained dietary behavior change, and psychological adjustment. *Motivation and Emotion, 28*(3), 245-277.

Pelletier, L. G., Fortier, M. S., Vallerand, R. J., & Briére, N. M. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. *Motivation and Emotion, 25*(4), 279-306.

Peng, W., & Crouse, J. (2013). Playing in parallel: The effects of multiplayer modes in active video game on motivation and physical exertion. *Cyberpsychology, behavior, and social networking, 16*(6), 423-427. doi: 10.1089/cyber.2012.0384

Peng, W., Lin, J. H., Pfeiffer, K. A., & Winn, B. (2012). Need satisfaction supportive game features as motivational determinants: An experimental study of a self-determination theory guided exergame. *Media Psychology, 15*(2), 175-196. doi: 10.1080/15213269.2012.673850

Pervin, L. A. (1968). Performance and satisfaction as a function of individual-environment fit. *Psychological Bulletin, 69*, 56-68.

Pescud, M., & Pettigrew, S. (2012). 'I know it's wrong, but . . .': a qualitative investigation of low-income parents' feelings of guilt about their child-feeding practices. *Maternal & Child Nutrition*, no-no. doi: 10.1111/j.1740-8709.2012.00425.x

Pihu, M., & Hein, V. (2007). Autonomy support from physical education teachers, peers and parents among school students: Trans-contextual motivational model. *Acta Kinesiologiae Universitatis Tartuensis, 12*, 116-128.

Piko, B. F., & Keresztes, N. (2006). Physical activity, psychosocial health, and life goals among youth. *Journal of community health, 31*(2), 136-145.

Plotnikoff, R. C., Costigan, S. A., Karunamuni, N., & Lubans, D. R. (2013). Social cognitive theories used to explain physical activity behavior in adolescents: A systematic review and meta-analysis. *Preventive Medicine, 56*(5), 245-253. doi: 10.1016/j.ypmed.2013.01.013

Power, T. G., Ullrich-French, S. C., Steele, M. M., Daratha, K. B., & Bindler, R. C. (2011). Obesity, cardiovascular fitness, and physically active adolescents' motivations for activity: A self-determination theory approach. *Psychology of Sport and Exercise, 12*(6), 593-598. doi: 10.1016/j.psychsport.2011.07.002

Pratt, K. J., Lamson, A. L., Lazorick, S., White, C. P., Collier, D. N., White, M. B., & Swanson, M. S. (2011). Conceptualising care for childhood obesity: a three-world view. *Journal of Children's Services, 6*(3), 156-171. doi: 10.1108/17466661111176024

Prochaska, J. J., Spring, B., & Nigg, C. R. (2009). Multiple health behavior change research: An introduction and overview. *Prev. Med., 46*(3), 181-188.

Puyau, M. R., Adolph, A. L., Vohra, F. A., Zakeri, I., & Butte, N. F. (2004). Prediction of activity expenditure using accelerometers in children. *Med Sci Sports Exerc., 36*(9), 1625-1631. doi: 10.1249/01.MSS.0000139898.30804.60

Quattrin, T., Roemmich, J. N., Paluch, R., Yu, J., Epstein, L. H., & Ecker, M. A. (2012). Efficacy of family-based weight control program for preschool children in primary care. *Pediatrics, 130*(4), 660-666. doi: 10.1542/peds.2012-0701

Radel, R., Sarrazin, P., Jehu, M., & Pelletier, L. G. (2013). Priming motivation through unattended speech. *British Journal of Social Psychology*, n/a-n/a. doi: 10.1111/bjso.12030

Radel, R., Sarrazin, P., Legrain, P., & Wild, T. C. (2010). Social contagion of motivation between teacher and student: Analyzing underlying processes. *Journal of Educational Psychology, 102*(3), 577-587.

Radel, R., Sarrazin, P., & Pelletier, L. G. (2009). Evidence of subliminally primed motivational orientations: The effects of unconscious motivational processes on the performance of a new motor task. *Journal of Sport & Exercise Psychology, 31*(5), 657-694.

Rangan, A. M., Schindeler, S., Hector, D. J., Gill, T. P., & Webb, K. L. (2008). Consumption of 'extra' foods by Australian children: types, quantities and contribution to energy and nutrient intakes. *European Journal of Clinical Nutrition, 2008*(62), 3.

Reeve, J. (1998). Autonomy support as an interpersonal motivating style: Is it teachable? *Contemporary Educational Psychology, 23*(3), 312-330. doi: 10.1006/ceps.1997.0975

Reeve, J. (2002). Self-determination theory applied to education settings. In E. L. Deci & R. M. Ryan (Eds.), *Handbook on self-determination research: Theoretical and applied issues* (pp. 183-204). Rochester, NY: University of Rochester Press.

Reeve, J. (2009). Why teachers adopt a controlling motivating style toward students and how they can become more autonomy supportive. *Educational Psychologist, 44*(3), 159-175. doi: 10.1080/00461520903028990

Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students' engagement by increasing teachers' autonomy support. *Motivation and Emotion, 28*(2), 147-169. doi: 0146-7239/04/0600-0147/0

Reichert, F. F., Baptista Menezes, A. M., Wells, J. C. K., Carvalho Dumith, S., & Hallal, P. C. (2009). Physical activity as a predictor of adolescent body fatness: A systemic review. *Sports Medicine, 39*(4), 279-294. doi: 10.2165/00007256-200939040-00002

Resnicow, K., Jackson, A., Blisset, D., Wang, T., McCarty, F., Rahotep, S., & Periasamy, S. (2005). Results of the Health Body Healthy Spirit Trial. *Health Psychology, 24*(4), 339-348. doi: 10.1037/0278-6133.24.4.339

Resnicow, K., Jackson, A., Braithwaite, R., DiIorio, C., Blisset, D., Rahotep, S., & Periasamy, S. (2002). Health body/health spirit: a church-based nutrition and physical activity intervention. *Health Education Research, 17*(5), 562-573.

Reuter, T., Ziegelmann, J. P., Wiedemann, A. U., & Lippke, S. (2008). Dietary planning as a mediator of the intention–behavior relation: An experimental-causal-chain design. *Applied Psychology, 57*, 194-207. doi: 10.1111/j.1464-0597.2008.00364.x

Reynolds, R. E., & Anderson, R. C. (1982). Influence of question on the allocation of attention during reading. *Journal of Educational Psychology, 74*(5), 623-632.

Reynolds, R. E., Standiford, S. N., & Anderson, R. C. (1979). Distribution of reading time when questions are asked about a restricted category of text information. *Journal of Educational Psychology, 71*(2), 183-190.

Rich, C., Geraci, M., Griffiths, L., Sera, F., Dezateux, C., & Cortina-Borja, M. (2013). Quality control methods in accelerometer data processing: Defining minimum wear time. *PLOS ONE, 8*(6), e67206. doi: 10.1371/journal.pone.0067206

Ringle, C. M., Wende, S., & Will, A. (2006). *SmartPLS (Version 2.0 (beta))*. Hamburg Germany: University of Hamburg.

Robertson, W., Friede, T., Blissett, J., Rudolf, M. C. J., Wallis, M., & Stewart-Brown, S. (2008). Pilot of "Families for Health": community-based family intervention for obesity. *Archives of Disease in Childhood, 93*(11), 921-928. doi: 10.1136/adc.2008.139162

Roblin, L. (2007). Childhood obesity: food, nutrient, and eating-habit trends and influences. *Applied Physiology, Nutrition, and Metabolism, 32*(4), 635-645. doi: 10.1139/h07-046

Rocchi, M. A., Pelletier, L. G., & Lauren, C. A. (2013). Determinants of coach motivation and autonomy supportive coaching behaviours. *Psychology of Sport and Exercise, 14*(6), 852-859. doi: 10.1016/j.psychsport.2013.07.002

Rodearmel, S. J., Wyatt, H. R., Stroebele, N., Smith, S. M., Ogden, L. G., & Hill, J. O. (2007). Small changes in dietary sugar and physical activity as an approach to preventing excessive weight gain: The America on the Move Family Study. *Pediatrics, 120*(4), e869-e879. doi: 10.1542/peds.2006-2927

Rodgers, W. M., Hall, C., Craig, R., & Munroe, K. J. (2001). Prediction of obligatory exercise by exercise-related imagery. *Psychology of Addictive Behaviors, 15*(2), 152-154.

Rodgers, W. M., Hall, C. R., Duncan, L. R., Pearson, E., & Milne, M. I. (2010). Becoming a regular exerciser: Examining change in behavioural regulations among exercise initiates. *Psychology of Sport and Exercise, 11*, 378-386. doi: 10.1016/j.psychsport.2010.04.007

Rofey, D. L., Kolko, R. P., & Iosif, A. (2009). A longitudinal study of childhood depression and anxiety in relation to weight gain. *Child Psychiatry and Human Development, 40*(4), 517-526. doi: 10.1007/s10578-009-0141-1

Rooney, B. L., Mathiason, M. A., & Schauberger, C. W. (2011). Predictors of obesity in childhood, adolescence, and adulthood in a birth cohort. *Maternal and Child Health Journal, 15*(8), 1166-1175. doi: 10.1007/s10995-010-0689-1

Rothkopf, E. Z., & Billington, M. J. (1979). Goal-guided learning from text: Inferring a descriptive processing model from inspective times and eye movements. *Journal of Educational Psychology, 17*(3), 310-327.

Rudisill, M. E. (1989). Influence of perceived competence and causal dimension orientation on expectations, persistence, and performance during perceived failure. *Research Quarterly for Exercise and Sport, 60*(2), 166-175. doi: 10.1080/02701367.1989.10607432

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43*(3), 450.

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*, 749-761.

Ryan, R. M., & Deci, E. L. (2002). AN overview of self-determination theory: An organismic-dialectical perspective. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination theory research* (pp. 3-33). Rochester NY: University of Rochester Press.

Ryan, R. M., & Deci, E. L. (2004). Avoiding death or engaging life as accounts of meaning and culture: Comment on Pyszcynski et al. *Psychological Bulletin, 130*(3), 473-477. doi: 10.1037/0033-2909.130.3.473

Ryan, R. M., La Guardia, J. G., Solky-Butzel, J., Chirkov, V., & Kim, Y. (2005). On the interpersonal regulation of emotions: Emotional reliance across gender, relationships, and cultures. *Personal Relationships, 12*(1), 145-163. doi: 10.1111/j.1350-4126.2005.00106.x

Ryan, R. M., Patrick, H., Deci, E. L., & Williams, G. C. (2008). Facilitating health behaviour change and its maintenance: Interventions based on self-determination theory. *The European Health Psychologist, 10*(1), 2-5.

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion, 30*(4), 344-360. doi: 10.1007/s11031-006-9051-8

Sallis, J. F., & Saelens, B. E. (2000). Assessment of physical activity by self-report: Status, limitations, and future directions. *Research Quarterly for Exercise and Sport, 71*(2), 1-14.

Salminen, M., Vahlberg, T., Ojanlatva, A., & Kivelä, S. (2005). Effects of a controlled family-based health education/counseling intervention. *American Journal of Health behavior, 29*(5), 395-406.

Sarrazin, P., Vallerand, R. J., Guillet, E., Pelletier, L. G., & Cury, F. (2002). Motivation and dropout in female handballers: A 21-month prospective study. *European Journal of Social Psychology, 32*(3), 395-418.

Schmalz, D. L., Deane, G. D., Birch, L. L., & Krahnstoever, D. K. (2007). A longitudinal assessment of the links between physical activity and self-esteem in early adolescent non-Hispanic females. *Journal of Adolescent Health, 41*(6), 559-565. doi: 10.1016/j.jadohealth.2007.07.001

Schneider, B. (1987). E = f (P, B): The road to a radical approach to person-environment fit. *Journal of Vocational Behavior, 31*, 353-361.

Schnoll, R., & Zimmerman, B. J. (2001). Self-regulation training enhances dietary self-efficacy and dietary fiber consumption. *Journal of the American Dietetic Association, 101*(9), 1006-1011.

Sebire, S. J., Haase, A. M., Montgomery, A. A., McNeill, J., & Jago, R. (2013). Associations between physical activity parenting practices and adolescent girls' self-perceptions and physical activity intentions. *Journal of physical activity & health*.

Sebire, S. J., Jago, R., Fox, K., Edwards, M., & Thompson, J. (2013). Testing a self-determination theory model of children's physical activity motivation: a cross-sectional study. *International*

Journal of Behavioral Nutrition and Physical Activity, 10(1), 111. doi: 10.1186/1479-5868-10-111

Sebire, S. J., Standage, M., Gillison, F. B., & Vansteenkiste, M. (2013). "Coveting thy neighbour's legs": A qualitative study of exercisers' experiences of intrinsic and extrinsic goal pursuit. *Journal of Sport & Exercise Psychology, 35*, 308-321.

Sebire, S. J., Standage, M., & Vansteenkiste, M. (2009). Examining intrinsic versus extrinsic exercise goals: cognitive, affective, and behavioral outcomes. *Journal of Sport & Exercise Psychology, 31*(2), 189-210.

Sebire, S. J., Standage, M., & Vansteenkiste, M. (2011). Predicting objectively assessed physical activity from the content and regulation of exercise goals: evidence for a mediational model. *Journal of Sport & Exercise Psychology, 33*, 175-197.

Segar, M. L., Eccles, J. S., & Richardson, C. R. (2008). Type of physical activity goal influences participation in healthy midlife women. *Women's Health Issues, 18*(4), 281-291. doi: 10.1016/j.whi.2008.02.003

Segar, M. L., Spruijt-Metz, D., & Nolen-Hoeksema, S. (2006). Go figure? Body-shape motives are associated with decreased physical activity participation among midlife women. *Sex Roles, 54*(3-4), 175-187. doi: 10.1007/s11199-006-9336-5

Shaikh, A. R., Vinokur, A. D., Yaroch, A. L., Williams, G. C., & Resnicow, K. (2011). Direct and mediated effects of two theoretically based interventions to increase consumption of fruits and vegetables in the healthy body healthy spirit trial. *Health Education & Behavior, 38*(5), 492-501. doi: 10.1177/1090198110384468

Sheldon, K. M., & Elliot, A. J. (1998). Not all personal goals are personal: Comparing autonomous and controlled reasons for goals as predictors of effort and attainment. *Personality and Social Psychology Bulletin, 24*, 546-557.

Sheldon, K. M., & Elliot, A. J. (1999). Goal striving, need satisfaction, and longitudinal well-being: The self-concordance model. *Journal of Personality and Social Psychology, 76*(3), 482-497. doi: 10.1037/0022-3514.76.3.482

Sheldon, K. M., Elliot, A. J., Kim, Y., & Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of Personality and Social Psychology, 80*(2), 325-339. doi: 10.1037//0022-3514.80.2.325

Sheldon, K. M., & Filak, V. (2008). Manipulating autonomy, competence, and relatedness support in a game-learning context: New evidence that all three needs matter. *British Journal of Social Psychology, 47*, 267-283. doi: 10.1348/014466607X238797

Sheldon, K. M., Gunz, A., Nichols, C. P., & Ferguson, Y. (2010). Extrinsic value orientation and affective forecasting: overestimating the rewards, underestimating the costs. *Journal of Personality, 78*(1), 149-178. doi: 10.1111/j.1467-6494.2009.00612.x

Sheldon, K. M., & Houser-Marko, L. (2001). Self-concordance, goal attainment, and the pursuit of happiness: can there be an upward spiral? *Journal of Personality and Social Psychology, 80*(1), 152-165. doi: 10.1037/0022-3514.80.2.325

Sheldon, K. M., & Kasser, T. (1998). Pursuing personal goals: skills enable progress, but not all progress is beneficial. *Personality and Social Psychology Bulletin, 24*(12), 1319-1331. doi: 10.1177/01461672982412006

Sheldon, K. M., Ryan, R. M., Deci, E. L., & Kasser, T. (2004). The independent effects of goal contents and motives on well-being: It's both what you pursue and why you pursue it. *Personality and Social Psychology Bulletin, 30*(4), 475-486. doi: 10.1177/0146167203261883

Sheldon, K. M., Turban, D. B., Brown, K. G., Barrick, M. R., & Judge, T. A. (2003). Applying self-determination theory to organizational research. *Research in Personnel and Human Resources Management, 22*, 357-393.

Shilts, M. K., Horowitz, M., & Townsend, M. S. (2004). Goal setting as a strategy for dietary and physical activity behavior change: A review of the literature. *American Journal of Health Promotion, 19*(2), 81-93. doi: 10.4278/0890-1171-19.2.81

Shilts, M. K., Horowitz, M., & Townsend, M. S. (2009). Guided goal setting: Effectiveness in a dietary and physical activity intervention with low-income adolescents. *International Journal of Adolescent Medicine and Health, 21*(1), 111-122. doi: 10.1515/ijamh.2009.21.1.111

Shilts, M. K., Townsend, M. S., & Dishman, R. K. (2013). Using goal setting to promote health behaviour change: diet and physical activity. In E. A. Locke & G. P. Latham (Eds.), *New developments in goal setting and task performance* (pp. 415-438). New York: Routledge.

Shrewsbury, V. A., King, I., Hattersley, I., Howlett, S. A., Hardy, L. L., & Baur, L. A. (2010). Adolescent-parent interactions and communication preferences regarding body weight and weight management: a qualitative study. *International Journal of Behavioral Nutrition and Physical Activity, 7*(16). doi: 10.1186/1479-5868-7-16

Shrewsbury, V. A., O'Connor, J., Steinbeck, K., Stevenson, K., Lee, A., Hill, A., . . . Baur, L. A. (2009). A randomised controlled trial of a community-based healthy lifestyle program for overweight and obese adolescents: the Loozit® study protocol. *BMC Public Health, 9*(1), 119.

Shrewsbury, V. A., Steinbeck, K. S., Torvaldsen, S., & Baur, L. A. (2011). The role of parents in pre-adolescent and adolescent overweight and obesity treatment: a systematic review of clinical recommendations. *Obesity Reviews, 12*(10), 759-769. doi: 10.1111/j.1467-789X.2011.00882.x

Silva, M. N., Markland, D., Carraça, E. V., Vieira, P. N., Coutinho, S. R., Minderico, C. S., . . . Teixeira, P. J. (2011). Exercise autonomous motivation predicts 3-yr weight loss in women. *Medicine and Science in Sports and Exercise, 43*(4), 728-737. doi: 10.1249/MSS.0b013e3181f3818f

Silva, M. N., Markland, D., Minderico, C. S., Vieira, P. N., Castro, M., Coutinho, S. R., . . . Teixeira, P. J. (2008). A randomized controlled trial to evaluate self-determination theory for exercise

adherence and weight control: rationale and intervention description. *BMC Public Health, 8*(1), 234.

Silva, M. N., Markland, D., Vieira, P. N., Coutinho, S. R., Carraça, E. V., Palmeira, A. L., . . . Teixeira, P. J. (2010). Helping overweight women become more active: Need support and motivational regulations for different forms of physical activity. *Psychology of Sport and Exercise, 11*(6), 591-601. doi: 10.1016/j.psychsport.2010.06.011

Silva, M. N., Vieira, P. N., Coutinho, S. R., Minderico, C. S., Matos, M. G., Sardinha, L. B., & Teixeira, P. J. (2010). Using self-determination theory to promote physical activity and weight control: a randomized controlled trial in women. *Journal of Behavioral Medicine, 33*(2), 110-122. doi: 10.1007/s10865-009-9239-y

Simons, J., Dewitte, S., & Lens, W. (2003). 'Don't do it for me. Do it for yourself!' Stressing the personal relevance enhances motivation in physical education. *Journal of Sport & Exercise Psychology, 25*(2), 145-160.

Slootmaker, S. M., Schuit, A. J., Chinapaw, M. J. M., Seidell, J. C., & van Mechelen, W. (2009). Disagreement in physical activity assessed by accelerometer and self-report in subgroups of age, gender, education and weight status. *International Journal of Behavioral Nutrition and Physical Activity, 6*(17). doi: 10.1186/1479-5868-6-17

Smith, A., Kellett, E., & Schmerlaib, Y. (1998). The Australian guide to healthy eating: background information for nutrition educators. Canberra: Commonwealth Department of Health and Family Services.

Smith, A. L., Ntoumanis, N., & Duda, J. L. (2007). Goal striving, goal attainment, and well-being: Adapting and testing the self-concordance model in sport. *Journal of Sport & Exercise Psychology, 29*(6), 763-782.

Smith, A. L., Ntoumanis, N., Duda, J. L., & Vansteenkiste, M. (2011). Goal striving, coping, and well-being: A prospective investigation of the self-concordance model in sport. *Journal of Sport & Exercise Psychology, 33*, 124-145.

Smith, K. L., Straker, L. M., Kerr, D. A., Davis, M. C., Fielding, A. M., Ward, E., & McManus, A. (2011). *The beginnings of CAFAP - a family-centred, multi-disciplinary program for overweight and obese adolescents and their families*. Paper presented at the Australian and New Zealand Obesity Society's Annual Scientific Meeting, Adelaide.

Smith, K. L., Straker, L. M., McManus, A., & Fenner, A. A. (2014). Barriers and enablers for participation in healthy lifestyle programs by adolescents who are overweight: a qualitative study of the opinions of adolescents, their parents and community stakeholders. *BMC Pediatrics, 14*(1), 53. doi: 10.1186/1471-2431-14-53

Sorof, J. M., Lai, D., Turner, J., Poffenbarger, T., & Portman, R. J. (2004). Overweight, ethnicity, and the prevalence of hypertension in school-aged children. *Pediatrics, 113*(3), 475-482.

Spear, B. A., Barlow, S. E., Ervin, C., Ludwig, D. S., Saelens, B. E., Schetzina, K. E., & Taveras, E. M. (2007). Recommendations for treatment of child and adolescent overweight and obesity. *Pediatrics, 120*(S254-288).

St. George, S. M., Wilson, D. K., Schneider, E., & Alia, K. A. (2013). Project SHINE: Effects of parent-adolescent communication on sedentary behavior in African American adolescents. *Journal of Pediatric Psychology*. doi: 10.1093/jpepsy/jst027

Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology, 75*(3), 411-433. doi: 10.1348/000709904x22359

Standage, M., & Gillison, F. (2007). Students' motivational responses toward school physical education and their relationship to general self-esteem and health-related quality of life. *Psychology of Sport and Exercise, 8*(5), 704-721. doi: 10.1016/j.psychsport.2006.12.004

Standage, M., Gillison, F. B., Ntoumanis, N., & Treasure, D. C. (2012). Predicting students' physical activity and health-related well-being: A prospective cross-domain investigation of motivation across school physical education and exercise settings. *Journal of Sport & Exercise Psychology, 34*, 37-60.

Standage, M., Sebire, S. J., & Loney, T. (2008). Does exercise motivation predict engagement in objectively assessed bouts of moderate-intensity exercise?: A self-determination theory perspective. *Journal of Sport & Exercise Psychology, 30*, 337-352.

Stanley, D. M., Cumming, J., Standage, M., & Duda, J. L. (2012). Images of exercising: Exploring the links between exercise imagery use, autonomous and controlled motivation to exercise, and exercise intention and behavior. *Psychology of Sport and Exercise, 13*(2), 133-141. doi: 10.1016/j.psychsport.2011.10.002

Stok, F. M., De Ridder, D. T. D., Adriaanse, M. A., & De Wit, J. B. F. (2010). Looking cool or attaining self-rule. Different motives for autonomy and their effects on unhealthy snack purchase. *Appetite, 54*(3), 607-610. doi: 10.1016/j.appet.2010.02.017

Story, M., Neumark-Sztainer, D., & French, S. (2002). Individual and environmental influences on adolescent eating behaviors. *Journal of the American Dietetic Association, 102*(3 Suppl), S40-51. doi: 10.1016/S0002-8223(02)90421-9

Strachan, S. M., & Brawley, L. R. (2009). Healthy-eater identity and self-efficacy predict healthy eating behavior: A prospective view. *Journal of Health Psychology, 14*(5), 684-695. doi: 10.1177/1359105309104915

Straker, L. M., Smith, K. L., Fenner, A. A., Kerr, D., McManus, A., Davis, M., . . . Abbott, R. A. (2012). Rationale, design and methods for a staggered-entry, waitlist controlled clinical trial of the impact of a community-based, family-centred, multidisciplinary program focussed on activity, food and attitude habits (Curtin University's Activity, Food and Attitudes Program-CAFAP) among overweight adolescents. *BMC Public Health, 12*, 471. doi: 10.1186/1471-2458-12-471

Strecher, V. J., Seijts, G. H., Kok, G. J., Latham, G. P., Glasgow, R., & DeVellis, B. (1995). Goal setting as a strategy for health behavior change. *Health Education & Behavior, 22*(2), 190-200. doi: 10.1177/109019819502200207

Stubbs, C. O., & Lee, A. J. (2004). The obesity epidemic: both energy intake and physical activity contribute. *Medical Journal of Australia, 181*(9), 489-491.

Su, Y. L., & Reeve, J. (2011). A meta-analysis of the effectiveness of intervention programs designed to support autonomy. *Educ Psychol Rev, 23*, 159-188. doi: 10.1007/s10648-010-9142-7

Taber, D. R., Stevens, J., Murray, D. M., Elder, J. P., Webber, L. S., Jobe, J. B., & Lytle, L. A. (2009). The effect of a physical activity intervention on bias in self-reported activity. *Ann Epidemiol, 19*(5), 316-322. doi: 10.1016/j.annepidem.2009.01.001

Taylor, I. M., & Ntoumanis, N. (2007). Teacher motivational strategies and student self-determination in physical education. *Journal of Educational Psychology, 99*(4), 747-760. doi: 10.1037/0022-0663.99.4.747

Taylor, I. M., Ntoumanis, N., & Standage, M. (2008). A self-determination theory approach to understanding the antecedents of teachers' motivational strategies in physical education. *Journal of Sport & Exercise Psychology, 30*(1), 75-94.

Taylor, J. P., Evers, S., & McKenna, M. (2005). Determinats of healthy eating in children and youth. *Canadian Journal of Public Health, 96*(3), S20-S26.

Teixeira, P. J., Carraça, E., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systemic review. *International Journal of Behavioral Nutrition and Physical Activity, 9*(78).

Terborg, J. R. (1976). The motivational components of goal setting. *Journal of Applied Psychology, 61*(5), 613-621.

Terborg, J. R., & Miller, H. E. (1978). Motivation, behavior and performance: A closer examination of goal setting and monetary incentives. *Journal of Applied Psychology, 63*(1), 29-39.

Tessier, D., Sarrazin, P., & Ntoumanis, N. (2010). The effect of an intervention to improve newly qualified teachers' interpersonal style, students motivation and psychological need satisfaction in sport-based physical education. *Contemporary Educational Psychology, 35*(4), 242-253. doi: 10.1016/j.cedpsych.2010.05.005

Tessier, D., Sarrazin, P. G., & Ntoumanis, N. (2008). The effects of an experimental programme to support students' autonomy on the overt behaviours of physical education teachers. *European Journal of Psychology of Education, 23*(3), 239-253.

Thøgersen-Ntoumani, C., & Ntoumanis, N. (2006). The role of self-determined motivation in the understanding of exercise-related behaviours, cognitions and physical self-evaluations. *Journal of Sports Sciences, 24*, 393-404.

Thøgersen-Ntoumani, C., Ntoumanis, N., & Nikitaras, N. (2010). Unhealthy weight control behaviours in adolescent girls: a process model based on self-determination theory. *Psychology & Health, 25*(5), 535-550. doi: 10.1080/08870440902783628

Timperio, A., van Stralen, M. M., Brug, J., Bere, E., Chinapaw, M., De Bourdeaudhuiji, I., . . . te Velde, S. (2013). Direct and indirect associations between the family physical activity environment and sports participation among 10-12 year-old European children: testing the EnRG framework in the ENERGY project. *International Journal of Behavioral Nutrition and Physical Activity, 10*(15). doi: 10.1186/1479-5868-10-15

Tirosh, A., Shai, I., Afek, A., Dubnov-Raz, G., Ayalon N, Gordon, B., . . . Rudich, A. (2011). Adolescent BMI trajectory and risk of diabetes versus coronary disease. *New England Journal of Medicine, 364*, 1315-1325. doi: 10.1056/NEJMoa1006992

Trost, S. G., McIver, K. L., & Pate, R. R. (2005). Conducting accelerometer-based activity assessments in field-based research. *Medicine & Science in Sports & Exercise, 37*(11), S531-S543. doi: 10.1249/01.mss.0000185657.86065.98

Twiddy, M., Wilson, I., Bryant, M., & Rudolf, M. (2012). Lessons learned from a family-focused weight management intervention for obese and overweight children. *Public Health Nutrition, 15*(7), 1310-1317. doi: 10.1017/S1368980011003211

Utter, J., Scragg, R., Schaaf, D., & Ni Mhurchu, C. (2010). Relationships between frequency of family meals, BMI and nutritional aspects of the home food environment among New Zealand

adolescents. *International Journal of Behavioral Nutrition and Physical Activity, 5*(50). doi: 10.1186/1479-5868-5-50

Van den Berghe, L., Soenens, B., Vansteenkiste, M., Aelterman, N., Cardon, G., Tallir, I. B., & Haerens, L. (2013). Observed need-supportive and need-thwarting teaching behavior in physical education: Do teachers' motivational orientations matter? *Psychology of Sport and Exercise, 14*(5), 650-661. doi: 10.1016/j.psychsport.2013.04.006

Van den Berghe, L., Vansteenkiste, M., Cardon, G., Kirk, D., & Haerens, L. (2012). Research on self-determination in physical education: key findings and proposals for future research. *Physical Education and Sport Pedagogy*, 1-25. doi: 10.1080/17408989.2012.732563

Vancouver, J. B., Thompson, C. M., & Williams, A. A. (2001). The changing signs in the relationships among self-efficacy, personal goals, and performance. *Journal of Applied Psychology, 86*(4), 605-620. doi: 10.1037//0021-9010.86.4.605

Vansteenkiste, M., Duriez, B., Simons, J., & Soenens, B. (2006). Materialistic values and well-being among business students: Further evidence of their detrimental effect. *Journal of Applied Social Psychology, 36*(12), 2892-2908. doi: 10.1111/j.0021-9029.2006.00134.x

Vansteenkiste, M., Lens, W., Soenens, B., & Luyckx, K. (2006). Autonomy and relatedness among Chinese sojourners and applicants: Conflictual or independent predictors of well-being and adjustment? . *Motivation and Emotion 30*(4), 273-287.

Vansteenkiste, M., Matos, L., Lens, W., & Soenens, B. (2007). Understanding the impact of intrinsic versus extrinsic goal framing on exercise performance: The conflicting role of task and ego involvement. *Psychology of Sport and Exercise, 8*(5), 771-794. doi: 10.1016/j.psychsport.2006.04.006

Vansteenkiste, M., Neyrinck, B., Niemiec, P., Soenens, B., De Witte, H., & Van den Broeck, A. (2007). On the relations among work value orientations, psychological need satisfaction and job outcomes: A self-determination theory approach. *Journal of Occupational and Organizational Psychology, 80*, 251-277. doi: 10.1348/096317906X111024

Vansteenkiste, M., Simons, J., Braet, C., Bachman, C., & Deci, E. L. (2007). *Promoting maintained weight loss through healthy lifestyle changes among severly obese children: An experimental test of self-determination theory*. Unpublished manuscript. University of Ghent, Belgium.

Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K., & Deci, E. L. (2004). Motivating learning, performance, and persistence: the synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *Journal of Personality and Social Psychology, 87*(2), 246-260. doi: 10.1037/0022-3514.87.2.246

Vansteenkiste, M., Simons, J., Lens, W., Soenens, B., Matos, L., & Lacante, M. (2004). Less is sometimes more: Goal content matters. *Journal of educational psychology, 96*(4), 755-764. doi: 10.1037/0022-0663.96.4.755

Vansteenkiste, M., Simons, J., Soenens, B., & Lens, W. (2004). How to become a persevering exerciser? Providing a clear, future intrinsic goal in an autonomy-supportive way. *Journal of Sport & Exercise Psychology, 26*(2), 232-249.

Vansteenkiste, M., Soenens, B., & Lens, W. (2007). Intrinsic veresus extrinsic goal promotion in exercise and sport. Understanding the differential impacts on performance and persistence. In M. S. Hagger & N. L. D. Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 167-180). Champaign, IL: Human Kinetics.

Vansteenkiste, M., Timmermans, T., Lens, W., Soenens, B., & Van den Broeck, A. (2008). Does extrinsic goal framing enhance extrinsic goal-oriented individuals' learning and performance? An experimental test of the match perspective versus self-determination theory. *Journal of Educational Psychology 100*(2), 387-397. doi: 10.1037/0022-0663.100.2.387

Varni, J., Limbers, C., Newman, D., & Seid, M. (2008). Longitudinal factorial invariance of the PedsQL™ 4.0 Generic Core Scales Child Self-Report Version: One year prospective evidence from the California State Children's Health Insurance Program (SCHIP). *Quality of Life Research, 17*(9), 1153-1162. doi: 10.1007/s11136-008-9389-3

Varni, J., Seid, M., & Kurtin, P. (2001). PedsQL™ 4.0: Reliability and validity of the Pediatric Quality of Life Inventory™ Version 4.0 generic core scales in healthy and patient populations. *Medical Care, 39*(8), 800-812.

Vartanian, L. R., Wharton, C. M., & Green, E. B. (2012). Appearance vs. health motives for exercise and for weight loss. *Psychology of Sport and Exercise, 13*(3), 251-256. doi: 10.1016/j.psychsport.2011.12.005

Verloigne, M., De Bourdeaudhuij, I., Tanghe, A., D'Hondy, E., Theuwis, L., Vansteenkiste, M., & Deforche, B. (2011). Self-determined motivation towards physical activity in adolescents treated for obesity: an observational study. *International Journal of Behavioral Nutrition and Physical Activity, 8*(97). doi: 10.1186/1479-5868-8-97

Verstuyf, J., Vansteenkiste, M., & Soenens, B. (2012). Eating regulation and bulimic symptoms: The differential correlates of health-focused and appearance-focused eating regulation. *Body Image, 9*(1), 108-117. doi: 10.1016/j.bodyim.2011.09.003

Vieira, P. N., Mata, J., Silva, M. N., Coutinho, S. R., Santos, T. C., Minderico, C. S., . . . Teixeira, P. J. (2011). Predictors of psychological well-being during behavioral obesity treatment in women. *Journal of Obesity*. doi: 10.1155/2011/936153

Vierling, K. K., Standage, M., & Treasure, D. C. (2007). Predicting attitudes and physical activity in an "at-risk" minority youth sample: A test of self-determination theory. *Psychology of Sport and Exercise, 8*(5), 795-817. doi: 10.1016/j.psychsport.2006.12.006

Wadden, T. A., Butryn, M. L., & Byrne, K. J. (2004). Efficacy of lifestyle modification for long-term weight control. *Obesity Research, 12*(S12), 151S-162S. doi: 10.1038/oby.2004.282

Wang, Y., Ge, K., & Popkin, B. M. (2003). Why do some overweight children remain overweight, whereas others do not? *Public Health Nutrition, 6*(06), 549-558. doi: 10.1079/PHN2003470

Wang, Z., Hu, X. Y., & Guo, Y. Y. (2013). Goal contents and goal contexts: Experiments with Chinese students. *The Journal of Experimental Education, 81*(1), 105-122. doi: 10.1080/00220973.2012.678407

Ward, J., Wilkinson, C., Graser, S. V., & Prusak, K. A. (2008). Effects of choice on student motivation and physical activity behavior in physical education. *Journal of Teaching in Physical Education, 27*(3), 385-398.

Watts, K., Bell, L. M., Byrne, S. M., Jones, T. W., & Davis, E. A. (2008). Waist circumference predicts cardiovascular risk in young Australian children. *Journal of Paediatrics and Child Health, 44*(12), 709-715. doi: 10.1111/j.1440-1754.2008.01411.x

Webb, T. L., & Sheeran, P. (2007). How do implementation intentions promote goal attainment? A test of component processes. *Journal of Experimental Social Psychology, 43*(2), 295-302. doi: 10.1016/j.jesp.2006.02.001

Weinberg, R. (1992). Goal setting and motor performance: A review and critique. In G. C. Roberts (Ed.), *Motivation in sport and exercise* (pp. 177-197). Champaign, IL: Human Kinetics.

Weinberg, R. (1994). Goal setting and performance in sport and exercise settings: a synthesis and critique. *Medicine and Science in Sports and Exercise, 26*(4), 469-477.

Weinberg, R., Butt, J., & Knight, B. (2001). High school coaches' perceptions of the process of goal setting. *The Sport Psychologist, 15*(1), 20-47.

Weinberg, R., Butt, J., Knight, B., & Perritt, N. (2001). Collegiate coaches' perceptions of ttheir goal-setting practices: A qualitative investigation. *Journal of Applied Sport Psychology, 13*(4), 374-398. doi: 10.1080/104132001753226256

West, F., Morawska, A., & Joughin, K. (2010). The Lifestyle Behaviour Checklist: evaluation of the factor structure. *Child: Care, Health and Development, 36*(4), 508-515. doi: 10.1111/j.1365-2214.2010.01074.x

West, F., Sanders, M. R., Cleghorn, G. J., & Davies, P. S. W. (2010). Randomised clinical trial of a family-based lifestyle intervention for childhood obesity involving parents as the exclusive agents of change. *Behaviour Research and Therapy, 48*(12), 1170-1179. doi: DOI: 10.1016/j.brat.2010.08.008

Wilfley, D. E., Tibbs, T. L., Van Buren, D. J., Reach, K. P., Walker, M. S., & Epstein, L. H. (2007). Lifestyle interventions in the treatment of childhood overweight: A meta-analytic review of randomized controlled trials. *Health Psychology, 26*(5), 521-532.

Williams, G. C. (2002). Improving patients' health through supporting the autonomy of patients and providers. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research*. Rochester, NY: The University of Rochester Press.

Williams, G. C., Saizow, R., Ross, L., & Deci, E. L. (1997). Motivation underlying career choice for internal medicine and surgery. *Social Science & Medicine, 45*(11), 1705-1713. doi: 10.1016/S0277-9536(97)00103-2

Williams, G. C., Teixeira, P. J., Carraça, E. V., & Resnicow, K. (2011). Physical wellness, health care, and personal autonomy. *Cross-Cultural Advancements in Positive Psychology, 1*(2), 133-162. doi: 10.1007/978-90-481-9667-8_7

Wilson, P. M., & Rodgers, W. M. (2004). The relationship between perceived autonomy support, exercise regulations and behavioral intentions in women. *Psychology of Sport and Exercise, 5*(3), 229-242. doi: 10.1016/s1469-0292(03)00003-7

Wolcott, D., Huberty, J., McIlvain, H., Rosenkranz, R., & Stacy, R. (2011). Changing health behaviors:Exploring families' participation in a family-based community intervention for overweight/obese children. *Childhood Obesity, 7*(3), 206-214. doi: 10.1089/chi.2011.0003

Wood, A., Kroll, L., Moore, A., & Harrington, R. (1995). Properties of the Mood and Feelings Questionnaire in adolescent psychiatric outpatients: A research note. *Journal of Child Psychology and Psychiatry, 36*(2), 327-334. doi: 10.1111/j.1469-7610.1995.tb01828.x

Wood, R. E., Mento, A. J., & Locke, E. A. (1987). Task complexity as a moderator of goal effects: A meta-analysis. *Journal of Applied Psychology, 72*, 416-425.

Wright, P. M. (1992). A theoretical examination of the construct validity of operationalizations of goal difficulty. *Human Resource Management Review, 2*(4), 275-298.

Young, K. M., Northern, J. J., Lister, K. M., Drummond, J. A., & O'Brien, W. H. (2007). A meta-analysis of family-behavioral weight-loss treatments for children. *Clinical Psychology Review, 27*(2), 240-249. doi: 10.1016/j.cpr.2006.08.003

Zabinski, M. F., Saelens, B. E., Stein, R. I., Hayden-Wade, H. A., & Wilfley, D. E. (2003). Overweight children's barriers to and support for physical activity. *Obesity Research, 11*(2), 238-246. doi: 10.1038/oby.2003.37

Zahra, J., Ford, T., & Jodrell, D. (2013). Cross-sectional survey of daily junk food consumption, irregular eating, mental and physical health and parenting style of British secondary school children. *Child: Care, Health and Development*. doi: 10.1111/cch.12068

Zeinstra, G. G., Renes, R. J., Koelen, M. A., Kok, F. J., & de Graaf, C. (2010). Offering choice and its effect on Dutch children's liking and consumption of vegetables: a randomized controlled trial. *The American Journal of Clinical Nutrition, 91*(2), 349-356. doi: 10.3945/ajcn.2009.28529

Zeller, M. H., Roehrig, H. R., Modi, A. C., Daniels, S. R., & Inge, T. H. (2006). Health-related quality of life and depressive symptoms in adolescents with extreme obesity presenting for bariatric surgery. *Pediatrics, 117*(4), 1155-1161. doi: 10.1542/peds.2005-1141

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology, 25*(1), 82-91. doi: 10.1006/ceps.1999.1016

Zizzi, S., Vitullo, E., Rye, J., O'Hara-Tompkins, N., Abildso, C., Fisher, B., & Bartlett, M. (2006). Impact of a three-week pedometer intervention on high school students' daily step counts and perceptions of physical activity. *American Journal of Health Education, 37*(1), 35-40. doi: 10.1080/19325037.2006.10598875

Footnotes

[1] Unless otherwise specified (i.e., 'adolescent participant' or 'parent participant'), 'participant' refers to both adolescent and parent participants.

[2] Content has been previously published by the author and her supervisors: From "Theoretical Underpinnings of a Need-Supportive Intervention to Address Sustained Healthy Lifestyle Changes in Overweight and Obese Adolescents," by A. A. Fenner, L. S. Straker, M. Davis, M. S. Hagger, 2013, *Psychology of Sport and Exercise, 14*(6), p. 819-829. Copyright 2013 by the Elsevier. Adapted with permission.

Consent was obtained from the publisher to allow text from the published manuscript to be included in the current thesis (see Appendix A) with only small amendments made to accommodate flow for the reader.

[3] Messages targeted more external reasons for acting as these goals are more aligned with exercise motivations more commonly endorsed in obese adolescents (Power et al., 2011). Autonomous motivations could then be fostered once enrolled in the intervention.

[4] κ values were interpreted based on the following standards for strength of agreement proposed by Landis and Koch (1977): ≤0 = poor, .01-.20 = slight, .21-.40 = fair, .41-.60 = moderate, .61-.80 = substantial and .81-1 = almost perfect.

[5] 25 adolescents and 20 parents had complete measures of goal attainment across all assessment periods. The number of adolescent/parent dyads with complete data for goal attainment and variables required to assess mediation hypothesised in study objectives included the following: objective 7 (*n* = 16), objective 8 (*n* = 16), objective 9 (*n* = 12), objective 10 (*n* = 15).

[6] Although PLS analysis accommodates small sample sizes, similar to other statistical approaches, findings from PLS analysis have the potential to be limited by power due to a small sample size.

[7] No demographic information was recorded. The assumption that the majority of adolescents and parents were of white ethnicity was based on visual observation.

Table 1

Intervention Session Topics

Week	Participants			
	Adolescents		Adults	
	Session 1	Session 2	Session 1	Session 2
1	Intro to program Intro to gym	Gym circuit Healthy eating[a]	Intro to program Program expectations	Walk and talk Healthy eating[a]
2	Gym circuit Healthy activity[a]	Gym circuit Portion size[a]	Parenting behaviours/ understanding teens Healthy activity[a]	Providing structure Portion size[a]
3	Gym circuit Intro to goal setting	Gym circuit Cont'd. Intro Goal setting[a]	Intro to goal setting Walk and talk	Fast food and dinner Goal setting[a]
4	Goals/gym circuit Family activity[a]	Gym circuit Family food[a]	Review and debrief progress/Goals Family activity[a]	Walk and talk Family food*
5	Goals/gym circuit Overcoming barriers[a]	Gym circuit Snacks[a]	Parent-teen relationships/Goals Overcoming barriers[a]	Walk and talk Snacks[a]
6	Goals/gym circuit Food labelling[a]	Gym Circuit Togetherness[a]	Food budgeting/Goals Food labelling[a]	Community activities Togetherness[a]
7	Gym circuit Goals[a]/Problem solving	Gym circuit Sensory lab/ food prep	Supermarket visit Goals[a]	Sensory lab/food prep Problem solving
8	Goals/gym circuit 3 month goals[a]	Gym circuit Cooking celebration[a]	Recipe ideas/Goals 3 month goals[a]	Cooking Prep Cooking celebration[a]

Note. [a]Joint sessions.

Table 2

Instructor Training Delivered at Each Wave by Discipline Type

Training	Dieticians	Physiotherapists/ Exercise Physiologist	Psychologists
Wave 1	2	2[a]	3[b]
Wave 2	0	1[c]	2
Wave 3	1[d]	1[d]	1[d]
Total	3	4	6

[a]One instructor watched video of first session and attended second session; [b]One instructor attended first session and watched video of second session; [c]Exercise physiologist; [d]Trained via Skype.

Table 3

Relationship Among Behaviour-Change Techniques, Change Mediators, and Change Outcomes for Self-Determination Theory Constructs (see Footnote 2)

Behaviour change technique *(need-supportive environment)*	Change mediator	Change outcome
Significant other[a] provides:	Self-determined behaviour:	*Adolescents*: Adherence to physical activity and healthy eating behaviours *Parents*: Adherence to behaviours that support adolescents' physical activity and healthy eating behaviours
• Autonomy support • Structure • Involvement	Feeling a sense of choice *(autonomy)* Feeling competent in abilities *(competence)* Feeling a sense of belonging *(relatedness)*	
Significant other[a] encourages:	Self-determined goal attainment:	
• Intrinsic goal content • Autonomous goal striving	Achieving goals related to health reasons Achieving goals related to interest/enjoyment	

Note. [a]Includes instructors (change objective: adolescents and parents) and parents (change objective: adolescents).

Table 4

Proposed Relationship Among Behaviour-Change Techniques, Change Mediators, and Change Outcomes for Goal Setting Theory Constructs

Behaviour change technique *(goal setting structure)*	Change mediator	Change outcome
• Goal difficulty	Effort and persistence	*Adolescent* goal attainment.
• Goal specificity	Effort, persistence, and direction	*Parent* goal attainment (of goals that map on to support adolescent goal striving).
• Goal proximity	Effort, persistence	

Table 5

Description of Behaviours, Delivery Mode, and the Needs Supported by Behaviours (see Footnote 2)

Behaviour type description	Methods for behaviour delivery	Need-support description	Experience of need support
Supporting choices. *(autonomy support)*	Offer several options for behaviour change using neutral language like "may" and "could" (instead of "should" or "must"). Offer verbal praise for attempts at behaviour change. Respond positively to participants' issues. Provide meaningful rationale for behaviours.	Feeling they can choose for themselves. (*autonomy*)	Feel they made their own choices to live by instead of someone else choosing for them or only doing behaviours to please others.
Providing structure. *(structure)*	Demonstrate leadership by modelling positive behaviour through demonstrations of goal setting and behaviour-change techniques. Give direct feedback to questions. Provide tasks that are challenging but "do-able".	Feeling competent in their abilities. (*competence*)	Feel like they can actually do the things they want to do, or tasks required by others
Being involved. *(involvement)*	Try to understand participants' motivations for behaviours. Talk with participants instead of at them. Show an interest in participants' well-being and progress in their behaviour changes.	Having a sense of belonging. (*relatedness*)	Feel like they have support without any external reinforcement like rewards from others.

Table 6

Description of Goal Setting Techniques, Underlying Theory, and Practical Strategies (see Footnote 2)

Adolescent goal steps	Adolescent example	Parent goal steps	Parent example
Set program goals for physical activity and healthy eating based on current behaviours *(distal)*	**Overall program goal:** To be moderately active 30 minutes 4-5 times a week.	Discuss with teen and record a copy of their physical activity and healthy eating goals *(distal)*	**Overall program goal:** Support my teen's goal to be moderately active 30 minutes 4-5 times a week.
Set weekly goals for physical activity and healthy eating, including perceived challenge *(proximal and difficult)*	**My goal this week is to:** Be moderately active for 15 minutes 4 times/ week. (Challenge: 7)	Discuss with teen, and set weekly goals for supporting their physical activity and healthy eating goals, including perceived challenge *(proximal and difficult)*	**My goal this week is to support my teen's goal to:** Be moderately active for 15 minutes 4 times/ week. (Challenge: 7)
Record reasons: "what you want to happen" and "why it is important" *(intrinsic and autonomous)*	**What:** To be more physically active. **Why:** I enjoy being active with friends.	Record reasons: "what you want to happen" and "why it is important" *(intrinsic and autonomous)*	**What:** My teen to be more physically active. **Why:** I enjoy being active with my teen and seeing him/her be active with friends.
Record daily behaviours to achieve *(specific)*	**Mon/Th:** CAFAP physical activity session **Tue:** Walk to/from school **Wed:** Zumba with mom 6.30 p.m. to 7.00 p.m. **Sat:** Walk one mile at park and bike ride 30 minutes with friend	Record daily behaviours to achieve *(specific)*	**Mon/Th:** Bring to CAFAP **Tue:** Allow teen to walk to/from school (e.g., try not to provide car ride) **Wed:** Zumba together 6.30 p.m. to 7.00 p.m. **Sat:** Family walk one mile at park and allow teen to ride bike 30 minutes with friend

Table 7

Entry Participant Characteristics

	Male *n* = 19		Female *n* = 49	
Variable	*M*	*SD*	*M*	*SD*
Age	13.43	1.45	14.30	1.58
BMI z-score	2.22	.38	2.06	.40

Table 8

Assessments Attended By Data Collection Period

Gender	Entry	Pre	Post	3-month	6-month	12-month
Wave 1	28	23	14	14	13	13
Wave 2	15	15[a]	12	9	8	6
Wave 3	25	20	18	17	16	15
Total	68	58[a]	44	40	37	34

[a]One participant completed only a pre-program assessment.

Table 9

Comparison of Entry Characteristics for Adolescent Completers and Adolescents Lost to Follow-Up at Post-Program Assessments and Pre-Program Assessments

	Completed		Lost to 3, 6, 12 m follow-up		Lost to post-program		Lost to pre-program	
Variable[a]	M(SD)	n	M(SD)	n	M(SD)	n	M(SD)	n
Age	13.4(1.5)	34	13.0(1.5)	11	14.3(1.5)	11	14.2(2.0)	11
BMI z-score	2.2(.4)	34	2.1(.3)	11	2.1(.4)	12	1.9(.6)	11
Junk food	5.8(3.4)	32	4.7(1.9)	11	6.5(4.9)	12	7.6(4.5)	3
Fruit/Veg.	2.0 (1.3)	32	1.53(1.2)	11	2.5(1.8)	12	.77(.6)	3
Self-rep. PA	3.0(.7)	34	2.9(.8)	11	3.0(.7)	12	2.7(.7)	8
Light PA[b]	15.2(3.9)	32	17.3(4.9)	10	15.2(3.8)	11	12.0(2.5)	6
MVPA[b]	2.4(1.7)	32	2.5(1.0)	10	3.8(2.3)	11	2.7(1.3)	6
Total PA[b]	17.5(4.8)	32	19.5(5.8)	10	18.5(5.6)	11	14.7(2.9)	6
A mot. HE	4.3(4.3)	33	5.0(5.2)	11	4.4(4.6)	11	4.5(3.1)	8
A mot. PA	5.8(5.5)	33	4.30(6.4)	11	4.1(6.6)	12	4.6(5.0)	8
Parent support HE	5.6(1.2)	33	5.2(1.1)	11	5.5(1.7)	12	5.7(1.5)	8
Parent support PA	5.0(1.4)	33	4.8(1.1)	11	5.4(1.8)	12	5.7(.9)	8
HRQL	67.1(14.3)	34	65.7(16.3)	11	74.4(15.3)	12	70.1(21.0)	8
Dep. Symp.	8.0(5.0)	34	9.6(5.4)	11	8.0(6.3)	12	11.3(7.7)	8

Note. BMI = body mass index; Junk food = junk food serves; Fruit/veg. = fruit and vegetable serves; Self-rep. PA = self-report physical activity; Light PA = accelerometer light physical activity; MVPA = accelerometer moderate-to-vigorous physical activity; Total PA = accelerometer light and moderate-to-vigorous physical activity; A mot. HE =autonomous motivation for healthy eating; A mot.PA = autonomous motivation for physical activity; Parent support HE = perceived parent support for healthy eating; Parent support PA = perceived parent support for physical activity; HRQL = health related quality of life; Dep. Symp. = depressive symptoms.

[a]Gender: Completed = 27 female and 7 male; lost to pre-program = 9 female and 2 male; lost to program = 7 female and 5 male; Lost to 3, 6, 12 month follow-up = 6 female and 5 male. [b]Amounts in minutes per hour.

Table 10

Comparison of Entry Characteristics for Parent Completers and Parents Lost to Follow-Up at Post-Program Assessments and Pre-Program Assessments

	Completed		Lost to 3, 6, 12 m follow-up		Lost to post-program		Lost to pre-program	
Variable[a]	M(SD)	n	M(SD)	n	M(SD)	n	M(SD)	n
A mot. to support PA	10.4(3.2)	34	11.4(3.5)	11	10.3(2.5)	10	10.1(2.7)	9
A mot. to support HE	8.4(3.6)	34	9.0(3.1)	11	7.9(5.2)	10	9.3(3.6)	9
Need-supp. behaviours	3.1(.5)	34	3.0(.5)	11	3.2(.5)	10	3.6(.4)*	9

Note. A mot. to support PA = autonomous motivation to support adolescents' physical activity behaviours; A mot. to support HE = autonomous motivation to support adolescents' healthy eating behaviours; Need-supp. Behaviours = parent demonstration of need-supportive behaviours.
*$p < .05$.

Table 11

Response Rates Across Data Collection Points

Variable	Entry	Pre	Post	3m	6m	12m	Total n
Adolescent outcomes							
BMI z-score	34	34	34	34	34	34	34
Junk food serves	32	34	25	29	30	30	22
Fruit and veg. serves	32	34	25	29	30	30	22
Self-report PA	34	34	34	33	33	34	32
Accelerometer PA[a]	32	32	25	22	23[b]	20	16
A mot. HE	33	34	34	33	33	34	31
A mot. PA	33	34	34	33	33	34	31
Parent support HE	33	34	34	33	33	34	31
Parent support PA	33	34	34	33	33	34	31
HRQL	34	34	34	33	33	34	32
Depressive symptoms	34	34	34	33	33	34	32
Goal attainment	--	--	28	28	30	30	25[c]
Parent outcomes							
A mot. to supp. HE	34	34	33	32	33	34	30
A mot. to supp. PA	34	34	33	32	33	34	30
Need-support behaviours	34	34	33	32	33	34	30
Goal attainment	--	--	27	28	28	27	20[d]

Note. Self-reported PA = self-reported physical activity; Accelerometer PA = accelerometer-based physical activity; A mot. HE = autonomous motivation for healthy eating; A mot. PA = autonomous motivation for physical activity; HRQL = health-related quality of life; A mot. to sup. HE = autonomous motivation to support adolescents' healthy eating; A mot. to supp. PA = autonomous motivation to support adolescents' physical activity.

[a]One 6-hour day wear time.[b]21 participants had accelerometer data across all follow-up points up to 6 months and were considered for analyses (includes one participant not displayed in the table who dropped out at 12 months). [c]Sixteen adolescent participants provided data up to 6 months inclusive of goal attainment and variables needed to conduct mediation analyses related to accelerometer-based physical activity, and 16 adolescent participants provided data up to 12 months inclusive of goal attainment and variables needed to conduct mediation analyses related to healthy eating outcomes. [d]Twelve parent participants provided data up to 6 months inclusive of goal attainment variables needed to conduct mediation analyses related to accelerometer-based physical activity, and 15 parent participants provided data up to 12 months inclusive of goal attainment variables needed to conduct mediation analyses related to healthy eating outcomes.

Table 12

Response Rates for Instructor Self-Report of Need-Supportive Behaviour Demonstration (Autonomy Support, Structure, and Involvement) and Session Observations by Wave and Observation Session

Measure	Wave 1		Wave 2		Wave 3	
	1[a]	2[b]	1[c]	2[c]	1[d]	2[d]
Self-report	7	6	6	6	9	9
Observation						
Rater 1	5	0	6	6	9	7
Rater 2	3	3	2	0	0	0
Rater 3	0	3	0	3	0	0

[a]Possible instructor *n* = 7. [b]Possible instructor *n* = 6. [c]Possible instructor *n* = 6.
[d]Possible instructor *n* = 9.

Table 13

Results of Waitlist Comparison

Variable	Entry Mean (SD)	Pre-test Mean (SD)	*p*-value
Adolescent outcomes			
BMI z-score	2.2(.37)	2.2(.40)	.810
Junk food serves	6.4(3.2)	5.0(3.3)	.042*
Fruit and vegetable serves	2.0(1.3)	2.0(1.3)	.820
Self-report physical activity	3.0(.7)	2.9(.7)	.933
Light physical activity	15.6(4.4)	15.2(4.4)	.985
Moderate-to-vigorous physical activity	2.1(1.6)	2.0(1.2)	.832
Total physical activity	17.7(5.1)	17.2(5.1)	.931
Autonomous motivation healthy eating	4.0(4.2)	3.1(4.1)	.156
Autonomous motivation physical activity	6.7(5.4)	5.2(4.4)	.530
Parent support healthy eating	5.5(1.3)	5.4(1.2)	.424
Parent support physical activity	4.9(1.4)	4.9(1.2)	.740
Physical-related quality of life	70.3(13.2)	70.0(14.0)	.969
Psychosocial-related quality of life	64.4(16.6)	66.3(19.0)	.512
Health-related quality of life	66.5(14.4)	67.6(15.3)	.620
Depressive symptoms	8.2(5.1)	7.4(4.7)	.244
Parent outcomes			
Autonomous motivation to support HE	8.2(3.8)	7.8(3.8)	.335
Autonomous motivation to support PA	10.7(3.4)	9.7(3.4)	.039*
Provision of need-supportive behaviours	3.1(.44)	3.1(.40)	.839

*$p < 0.05$.

Table 14

Instructor Self-Report of Need-Supportive Behaviour Demonstrations (Autonomy Support, Structure, and Involvement)

Instructor	W1O1	W1O2	W2O1	W2O2	W3O1	W3O2	Average
Psychologist							
South metro. A	2.70	3.40	--	--	--	--	3.05
South metro. B	--	--	3.67	3.13	2.93	3.27	3.25
East metro. A	2.47	--	--	--	--	--	2.47
East metro. B	2.67	3.00	--	--	--	--	2.83
East metro. C	--	--	3.40	3.40	3.27	3.47	3.38
Regional	--	--	--	--	2.67	3.60	3.13
Physiotherapist							
South metro. A	3.07	3.00	--	--	--	--	3.03
South metro. B[a]	--	--	3.27	3.20	3.27	3.60	3.33
East metro.	3.73	4.00	4.00	3.80	4.00	4.00	3.92
Regional	--	--	--	--	2.93	3.20	3.06
Dietician							
South metro.	2.60	3.67	3.47	3.67	3.13	3.07	3.26
East metro.	2.87	3.70	3.67	3.80	3.60	3.77	3.56
Regional	--	--	--	--	3.07	3.27	3.17

Note. W1O1 = wave 1 observation 1; W1O2 = wave 1 observation 2; W2O1 = wave 2 observation 1; W2O2 = wave 2 observation 2; W3O1 = wave 3 observation 1; W3O2 = wave 3 observation 2; average = mean self-report rating. Scale ranged from 1 (*not true at all*) to 4 (*very true*).

[a]Exercise physiologist.

Table 15

Rater-Observations of Instructor Need-Supportive Behaviour Demonstrations (Autonomy Support, Structure, and Involvement)

Instructor	W1O1	W1O2	W2O1	W2O2	W3O1	W3O2	Average
Psychologist							
South metro. A	6.22	5.95	--	--	--	--	6.08
South metro. B	--	--	7.00	6.77	6.55	5.62	6.48
East metro. A	6.35	--	--	--	--	--	6.35
East metro. B	7.00	6.15	--	--	--	--	6.57
East metro. C	--	--	6.94	7.00	6.94	6.86	6.93
Regional	--	--	--	--	3.31	3.36	3.33
Physiotherapist							
South metro. A	6.79	7.00	--	--	--	--	6.89
South metro. B[a]	--	--	6.85	6.90	6.70	7.00	6.86
East metro.	7.00	6.86	6.88	6.92	6.74	6.97	6.89
Regional	--	--	--	--	6.94	7.00	6.97
Dietician							
South metro.	6.72	6.18	6.55	5.50	6.09	NA	6.20
East metro.	6.19	5.11	6.43	6.09	6.30	NA	6.02
Regional	--	--	--	--	6.92	7.00	6.96

Note. W1O1 = wave 1 observation 1; W1O2 = wave 1 observation 2; W2O1 = wave 2 observation 1; W2O2 = wave 2 observation 2; W3O1 = wave 3 observation 1; W3O2 = wave 3 observation 2; average = mean observation rating; NA = not available due to recorded session turning up missing. Scale ranged from 1 (*behaviours that thwart need satisfaction*) to 7 (*behaviours that nurture basic needs*).
[a]Exercise physiologist.

Table 16

Rater-Observations of Instructor Need-Supportive Behaviour (Goal Setting) Demonstrations

Instructor	Wave 1		Wave 2		Wave 3		Average	
	IC	AM	IC	AM	IC	AM	IC	AM
Psychologist								
South metro. A	4[a]	4[a]	--	--	--	--	4[a]	4[a]
South metro. B	--	--	NR	NR	4[a]	4[a]	4[a]	4[a]
East metro. A[b]	--	--	--	--	--	--	--	--
East metro. B	6	4[a]	--	--	--	--	6	4[a]
East metro. C	--	--	4[a]	4[a]	7	7	5.5	5.5
Regional[c]	--	--	--	--	--	--	--	--
Physiotherapist	4[a]	4[a]	4[a]	4[a]	4[a]	4[a]	4[a]	4[a]
South metro. A	4[a]	4[a]	--	--	--	--	4[a]	4[a]
South metro. B[d]	--	--	NR	NR	6	6	6	6
East metro.	4[a]	4[a]	4[a]	4[a]	4[a]	4[a]	4[a]	4[a]
Regional[e]	--	--	--	--	NR	NR	--	--
Dietician	4[a]	4[a]	4[a]	4[a]	4[a]	4[a]	4[a]	4[a]
South metro.	4[a]	4[a]	NR	NR	NA	NA	4[a]	4[a]
East metro.	4[a]	4[a]	4[a]	4[a]	NA	NA	4[a]	4[a]
Regional	--	--	--	--	7	7	7	7

Note. IC = intrinsic goal content; AM = autonomous goal motives; NA = not available due to recorded session turning up missing; Scale ranged from 1 (*behaviours that thwart need satisfaction*) to 7 (*behaviours that nurture basic needs*).

[a]Instructors were assigned a score of 4 if neither goal content (e.g., intrinsic or extrinsic) or motives for goal strivings (e.g., autonomous or controlling) were promoted; [b]Instructor was not assigned goal setting content to deliver due to splitting content with another instructor (psychologist B); [c]Instructor was not included in goal setting content delivery during scheduled observation session and no additional sessions available for observation of goal setting; [d]Exercise physiologist; [e]Observation was included due to instructor absence at the only session assigned for involvement in goal setting delivery, this session was handled solely by the dietician.

Table 17

Adolescent Perceptions of Instructor Need-Support

	South metropolitan			East metropolitan			Regional
Outcome behaviour	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	Wave 3
Physical activity	6.4(1.0)	6.8(.2)	6.2(.3)	5.4(1.8)	5.9(.4)	5.3(1.7)	5.8(1.1)
Healthy eating	6.1(1.3)	6.9(.7)	6.1(.5)	5.8(1.1)	5.4(.6)	6.3(.5)	6.0(.8)

Note. Scale ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). Includes responses from participants in attendance at post-program assessment that did not remain in the study for the duration of the 12-month follow-up (total *n* = 47).

Table 18

Parent Perceptions of Instructor Need-Support

	South metropolitan			East metropolitan			Regional
Outcome behaviour	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	Wave 3
Physical activity	4.2(1.5)	6.1(.9)	6.0(.5)	6.0(.8)	5.2(1.8)	5.4(1.2)	6.5(.9)
Healthy eating	5.3(1.6)	6.4(.8)	6.0(.7)	6.3(.8)	5.6(1.5)	5.7(1.3)	6.7(.5)

Note. Scale ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). Includes responses from participants in attendance at post-program assessment that did not remain in the study for the duration of the 12-month follow-up (total *n* = 42).

Table 19

Means and Standard Deviations for Adolescent Self-Determination Theory Outcomes

	Data collection period											
	Entry		Pre		Post[a]		3 months[b]		6 months[c]		12 months[d]	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Autonomous motivation PA	5.65	5.36	5.20	4.44	7.05	5.16	7.36	5.46	7.88**	5.08	8.17*	5.07
Autonomous motivation HE	3.99	4.19	3.13	4.09	5.54**	4.79	5.70***	4.90	5.13*	4.96	5.15*	4.74
Support for PA	4.93	1.35	4.92	1.18	5.80*	1.21	5.57*	1.34	5.66*	1.08	5.58	1.29
Support for HE	5.51	1.26	5.36	1.15	6.00*	1.09	5.84	1.20	5.78	1.17	5.83	1.28

Note. PA = physical activity; HE = healthy eating. Support = perceived parent support (e.g., autonomy support, structure, and involvement). Means and standard deviations are reported for participants with complete data at the 12-month follow-up (*n* = 31).

[a]Significant pairwise comparisons refer to waitlist (entry – pre) and post program (entry – post) change scores. [b]Significant pairwise comparisons refer to waitlist (entry – pre) and 3-month follow-up (entry – 3 months) change scores. [c]Significant pairwise comparisons refer to waitlist (entry – pre) and 6-month follow-up (entry – 6 months) change scores. [d]Significant pairwise comparisons refer to waitlist (entry – pre) and 12-month follow-up (entry – 12 months) change scores. Scale scores for autonomous motivation (physical activity and healthy eating) were weighted (e.g., -3 to +3) using a scale ranged from 1 (*not at all true*) to 4 (*very true*). Scale for perceived parent support (physical activity and healthy eating) ranged from 1 (*strongly disagree*) to 7 (*strongly agree*).

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 20

Means and Standard Deviations for Adolescent Psychological Outcomes

	Data collection period											
	Entry		Pre		Post[a]		3 months[b]		6 months[c]		12 months[d]	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Quality of Life												
Physical	70.31	13.21	70.02	14.04	78.51	14.06	79.20*	14.19	83.30***	11.76	77.25	18.35
Psychosocial	64.43	16.64	66.25	18.97	73.10	19.05	75.00	22.53	76.41**	22.26	72.63	20.60
Health	66.47	14.42	67.56	15.29	74.98*	16.23	76.46*	18.50	78.80***	17.09	74.23	15.47
Depressive symptoms	8.15	5.11	7.41	4.72	6.10	5.69	6.31	6.49	5.44	5.41	6.31	5.65

Note. Means and standard deviations are reported for participants with complete data across all six assessment periods (n = 31).
[a]Significant pairwise comparisons refer to waitlist (entry – pre) and post program (entry – post) change scores. [b]Significant pairwise comparisons refer to waitlist (entry – pre) and 3-month follow-up (entry – 3 months) change scores. [c]Significant pairwise comparisons refer to waitlist (entry – pre) and 6-month follow-up (entry – 6 months) change scores. [d]Significant pairwise comparisons refer to waitlist (entry – pre) and 12-month follow-up (entry – 12 months) change scores. Scores for quality of life measures ranged from 0 to 100, with high scores indicating a greater quality of life.
*p < 0.05. **p < 0.01. ***p < 0.001.

Table 21

Means and Standard Deviations for Healthy Lifestyle Behaviour Outcomes

	Data collection period											
	Entry		Pre		Post[a]		3 months[b]		6 months[c]		12 months[d]	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Self-report physical activity	2.95	.65	2.92	.73	3.09	.65	3.15	.72	3.28	.73	3.16	.85
Accelerometer												
Light PA	15.56	4.36	15.19	4.38	15.76	4.08	16.61	5.55	15.36	5.41	--	--
Moderate-to-vigorous PA	2.12	1.59	2.04	1.15	2.37	1.37	2.20	1.24	2.19	1.62	--	--
Total PA	17.68	5.12	17.23	5.12	18.13	4.77	18.81	6.05	17.54	5.86	--	--
Junk food serves	6.35	3.19	5.00	3.33	2.59*	2.22	3.05*	1.82	2.66*	2.00	3.05*	2.17
Fruit and vegetable serves	2.04	1.32	2.03	1.27	2.30	1.39	2.23	1.64	2.93	1.34	2.34	1.79

Note. PA = physical activity. Total PA = light and moderate-to-vigorous physical activity. Means and standard deviations are reported for participants with complete data at the 12-month follow-up (self-report physical activity $n = 31$; accelerometer-based physical activity $n = 19$; food diary $n = 22$).
[a]Significant pairwise comparisons refer to waitlist (entry – pre) and post program (entry – post) change scores. [b]Significant pairwise comparisons refer to waitlist (entry – pre) and 3-month follow-up (entry – 3 months) change scores. [c]Significant pairwise comparisons refer to waitlist (entry – pre) and 6-month follow-up (entry – 6 months) change scores. [d]Significant pairwise comparisons refer to waitlist (entry – pre) and 12-month follow-up (entry – 12 months) change scores. Scale for physical activity frequency ranged from 1 (*not at all*) to 5 (*6-7 days x week*).
*$p < 0.05$.

Table 22

Means and Standard Deviations for Parent Self-Determination Theory Outcomes

	Data collection period											
	Entry		Pre		Post[a]		3 months[b]		6 months[c]		12 months[d]	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Autonomous motivation to support PA	10.61	3.38	9.71	3.35	11.27*	2.99	10.39	3.14	10.43	3.70	9.92	3.24
Autonomous motivation to support HE	8.20	3.70	7.76	3.75	9.16	3.81	8.90	3.98	8.98	3.82	8.71	3.89
Provision of need-support	3.02	.52	3.06	.42	3.26*	.39	3.14	.46	3.21	.47	3.08	.42

Note. PA = physical activity; HE = healthy eating. Means and standard deviations are reported for participants with complete data at the 12-month follow-up (n = 30). [a]Significant pairwise comparisons refer to waitlist (entry – pre) and post program (entry – post) change scores. [b]Significant pairwise comparisons refer to waitlist (entry – pre) and 3-month follow-up (entry – 3 months) change scores. [c]Significant pairwise comparisons refer to waitlist (entry – pre) and 6-month follow-up (entry – 6 months) change scores. [d]Significant pairwise comparisons refer to waitlist (entry – pre) and 12-month follow-up (entry – 12 months) change scores. Scale scores for autonomous motivation (physical activity and healthy eating) were weighted (e.g., -3 to +3) using a scale ranged from 1 (*not at all true*) to 4 (*very true*). Scores for provision of need-support ranged from 1 (*not true at all*) to 4 (*very true*).
*$p < 0.05$.

Table 23

Beta Coefficients for Direct and Indirect Pathways in the Proposed Model (Objective 3.1) Using Self-Reported Physical Activity

Model	Direct			Indirect
Supp. PA→ A Mot. PA→ PA	A Mot. PA → PA	Supp. PA → A Mot. PA	Supp. PA → PA	Supp. PA → PA
Entry – Post	-.059	.029	-.163	-.161
Entry – 3 months	.126	.086	-.114	-.126
Entry – 6 months	.123	.142	-.244	-.267
Entry – 12 months	.095	.172	-.057	-.076

Note. Supp. PA = adolescent perceived parent support for physical activity; A Mot. PA = adolescent autonomous motivation for physical activity; PA = adolescent self-reported physical activity. *n* = 31.

Table 24

Beta Coefficients for Direct and Indirect Pathways in the Proposed Model (Objective 3.1) Using Accelerometer-Based Physical Activity[a]

Model	Direct			Indirect
	A Mot. PA → PA	Supp. PA → Mot. PA	Supp. PA → PA	Supp. PA → PA
Supp. PA→ A Mot. PA→ LPA				
E – Post	.291	.077	-.020	-.043
E – 3 months	-.133	.102	.135	.150
E – 6 months	-.236	.136	.398**	.438*
Supp. PA→ A Mot. PA→ MVPA				
E – Post	-.104	-	-.374	-.368
E – 3 months	-.105	-	-.300	-.293
E – 6 months	.046	-	.161	.158
Supp. PA→ A Mot. PA→ LMVPA				
E – Post	.209	-	-.183	-.201
E – 3 months	-.139	-	-.001	.014
E – 6 months	-.204	-	.403**	.439*

Note. Supp. PA = adolescent perceived parent support for physical activity; A Mot. PA = adolescent autonomous motivation for physical activity; LPA = light intensity physical activity; MVPA = moderate-to-vigorous intensity physical activity; LMVPA = light and moderate-to-vigorous (total) physical activity. n = 19. *p < .05. **p < .01.

[a]Changes in the relationship between adolescent perceived parent support for physical activity and adolescent autonomous motivation for physical activity are presented again in Table 24, as the previously reported relationship (e.g., Table 23) was drawn from a different number of cases.

Table 25

Beta Coefficients for Direct and Indirect Pathways in the Proposed Model (Objective 3.2)

Model	Direct					Indirect	
	A Mot. HE → FV	A Mot. HE → JF	Supp. HE → A Mot. HE	Supp. HE → FV	Supp. HE → JF	Supp. HE → FV	Supp. HE → JF
Supp. HE→ A Mot. HE→JF							
E – Post	-	-.039	.399	-	.023	-	.046
E – 3 months	-	-.131	.014	-	.146	-	.147
E – 6 months	-	-.078	.158	-	-.256	-	-.250
E – 12 months	-	.219	-.184	-	-.072	-	-.033
Supp. HE→ A Mot. HE→FV							
E – Post	.124	-	-	.378	-	.391	-
E – 3 months	-.273*	-	-	.144	-	.148	-
E – 6 months	.173	-	-	.330	-	.310	-
E – 12 months	-.309	-	-	.047	-	-.011	-

Note. A Mot. HE = adolescent autonomous motivation for healthy eating; FV = adolescent fruit and vegetable serves; JF = adolescent junk food serves; Supp. HE = adolescent perceived parent support for healthy eating. n = 22.
*p < .05.

Table 26

Beta Coefficients for Direct and Indirect Pathways in Proposed Models (Objective 3.3)

Model	Direct					Indirect	
	A Mot. PA → HRQL	Supp. PA → HRQL	A Mot. HE → HRQL	Supp. HE → A Mot. HE	Supp. HE → HRQL	Supp. PA → HRQL	Supp. HE → HRQL
Supp. PA→ A Mot. PA→HRQL							
Entry – Post	.253	-.341*	-	-	-	-.349*	-
Entry – 3 months	.437**	.220	-	-	-	.184	-
Entry – 6 months	.445**	.047	-	-	-	-.017	-
Entry – 12 months	.401**	.045	-	-	-	-.025	-
Supp. HE→ A Mot. HE→HRQL							
Entry – Post	-	-	.183	.274	-.301*	-	-.379*
Entry – 3 months	-	-	.497**	.130	.096	-	.032
Entry – 6 months	-	-	.256	.201	.006	-	-.047
Entry – 12 months	-	-	.380	-.133	.087	-	.140

Note. A Mot. PA = adolescent autonomous motivation for physical activity; HRQL = adolescent health-related quality of life; Supp. PA = adolescent perceived parent support for physical activity; Supp. HE = adolescent perceived parent support for healthy eating; A Mot. HE = adolescent autonomous motivation for healthy eating. Beta coefficients for the relationship between changes in adolescent perceived parent support for physical activity and changes in adolescent autonomous motivation for physical activity are excluded from the table as these were previously reported in relation to objective one (see Table 23), which employed the same sample as that used in analyses exploring proposed pathways in objective three. n = 31.
*p < .05. **p < .01.

Table 27

Beta Coefficients for Direct and Indirect Pathways in Proposed Models (Objective 3.4)

Model	Direct				Indirect	
	A Mot. PA → DS	Supp. PA → DS	A Mot. HE → DS	Supp. HE → DS	Supp. PA → DS	Supp. HE → DS
Supp. PA→ A Mot. PA→DS						
Entry – Post	-.441**	-.217	-	-	-.204	-
Entry – 3 months	-.458**	-.456**	-	-	-.420**	-
Entry – 6 months	-.313**	-.383**	-	-	-.345*	-
Entry – 12 months	-.436**	-.198	-	-	-.127	-
Supp. HE→ A Mot. HE→DS						
Entry – Post	-	-	-.365	-.190	-	-.100
Entry – 3 months	-	-	-.486**	-.197	-	-.139
Entry – 6 months	-	-	-.239	-.369*	-	-.334*
Entry – 12 months	-	-	.065	-.167	-	-.161

Note. A Mot. PA = adolescent autonomous motivation for physical activity; DS = adolescent depressive symptoms; Supp. PA = adolescent perceived parent support for physical activity; A Mot. HE = adolescent autonomous motivation for healthy eating; Supp. HE = adolescent perceived parent support for healthy eating. Beta coefficients for the relationship between changes in adolescent perceived parent support (physical activity and healthy eating) predicting changes in adolescent autonomous motivation (physical activity and healthy eating) were excluded from the table as these were previously reported in relation to objective one (physical activity; see Table 23) and objective 3 (healthy eating; see Table 26), which employed the same sample as that used in analyses exploring pathways proposed in objective four. n = 31. *p < .05. **p < .01.

Table 28

Beta Coefficients for Direct and Indirect Pathways in Proposed Models (Objective 3.5) Using Self-Reported Physical Activity

Model	Direct					Indirect	
	N.S. → PA	N.S. → Supp. PA	P. Mot. PA → N.S.	P .Mot PA → PA	P .Mot PA → Supp. PA	P. Mot PA → Supp. PA	P. Mot. PA → PA
P. Mot. PA→ N.S.→Supp. PA →PA							
Entry – Post	.099	-.012	.360*	-.040	-.373*	-.423**	-.087
Entry – 3 months	.005	.007	.097	-.040	-.124	-.126	-.041
Entry – 6 months	.229	-.090	.217	.278	.218	.249	.240
Entry – 12 months	.030	.165	.241	.012	.096	.029	.005

Note. P. Mot PA = Parent autonomous motivation to support adolescent physical activity behaviour; N.S. = parent report of need-supportive behaviour demonstrations; PA = adolescent self-reported physical activity behaviour; Supp. PA = adolescent perceived parent support for physical activity; Mot. PA = adolescent autonomous motivation for physical activity. *n* = 29.
*$p < .05$. **$p < .01$.

Table 29

Beta Coefficients for Direct and Indirect Pathways in Proposed Models (Objective 3.5) Using Accelerometer-Based Physical Activity[a]

Model	Direct					Indirect	
	N.S. → PA	N.S. → Supp. PA	P. A Mot. PA → N.S.	P. A Mot PA → PA	P. A Mot PA → Supp. PA	P. A Mot PA → PA	P. A Mot PA → Supp. PA
P. A Mot. PA→ N.S.→Supp. PA →LPA							
Entry – Post	-.439*	-.277	.564**	-.403*	-.203	-.195	-.069
Entry – 3 months	-.318*	-.270	-.061	-.103	-.179	-.123	-.197
Entry – 6 months	-.477*	-.225	.090	.169	.205	.214	.227
P. A Mot. PA→ N.S.→Supp. PA →MVPA							
Entry – Post	.047	-	-	.036	-	.014	-
Entry – 3 months	-.290	-	-	-.019	-	-.037	-
Entry – 6 months	.292	-	-	-.077	-	-.104	-
P. A Mot. PA→ N.S.→Supp. PA →LMVPA							
Entry – Post	-.366*	-	-	-.340	-	-.229	-
Entry – 3 months	-.339*	-	-	-.086	-	-.107	
Entry – 6 months	-.370	-	-	.138	-	.172	-

Note. N.S. = parent report of need-supportive behaviour demonstrations; P. A Mot. PA = Parent autonomous motivation to support adolescent physical activity; Supp. PA = adolescent perceived parent support for physical activity; LPA = light intensity physical activity; MVPA = moderate-to-vigorous intensity physical activity; LMVPA = light and moderate-to-vigorous (total) physical activity. The relationship among changes in parent autonomous motivation to support adolescent physical activity, parent demonstration of need-supportive behaviours, adolescent perceived parent support for physical activity and adolescent autonomous motivation for physical activity are presented again, as the previously reported relationships (e.g., Table 28) were drawn from a different number of cases. n = 17.

*p < .05. **p < .01.

[a]The relationship among changes in parent autonomous motivation to support adolescent physical activity, parent demonstration of need-supportive behaviours, adolescent perceived parent support for physical activity and adolescent autonomous motivation for physical activity are presented again in Table 29, as the previously reported relationships (e.g., Table 28) were drawn from a different number of cases.

Table 30

Beta Coefficients for Direct and Indirect Pathways in Proposed Models (Objective 3.6)

Model	Direct							Indirect		
	N.S. → Supp. HE	N.S. → JF	N.S. → FV	P. A Mot. HE → N.S.	P. A Mot HE → Supp. HE	P. A Mot HE → JF	P. A Mot HE → FV	P. Mot HE → JF	P. A Mot HE → FV	P. A Mot HE → Supp. HE
P. A Mot. HE→ N.S.→Supp. HE →JF										
Entry – Post	-.139	-	-.072	-.442*	.028	-	.210	-	.221	.026
Entry – 3 months	-.245	-	.079	.160	-.715**	-	-.282*	-	-.302*	-.694**
Entry – 6 months	-.273	-	.048	.112	-.088	-	.060	-	.055	-.058
Entry – 12 months	.208	-	.198	.198	-.159	-	.153	-	.124	-.197
P. A Mot. HE→ N.S.→Supp. HE →FV										
Entry – Post	-	-.052	-	-	-	-.073	-	-.120	-	-
Entry – 3 months	-	-.106	-	-	-	-.082	-	-.067	-	-
Entry – 6 months	-	-.114	-	-	-	-.498**	-	-.492**	-	-
Entry – 12 months	-	-.117	-	-	-	-.125	-	-.109	-	-

Note. N.S. = parent report of need-supportive behaviour demonstrations; Supp. HE = adolescent perceived parent support for healthy eating; JF =adolescent junk food serves; FV; adolescent fruit and vegetable serves; P. A Mot. HE = parent autonomous motivation to support adolescent healthy eating. *n* = 21.
*p < .05. **p < .01

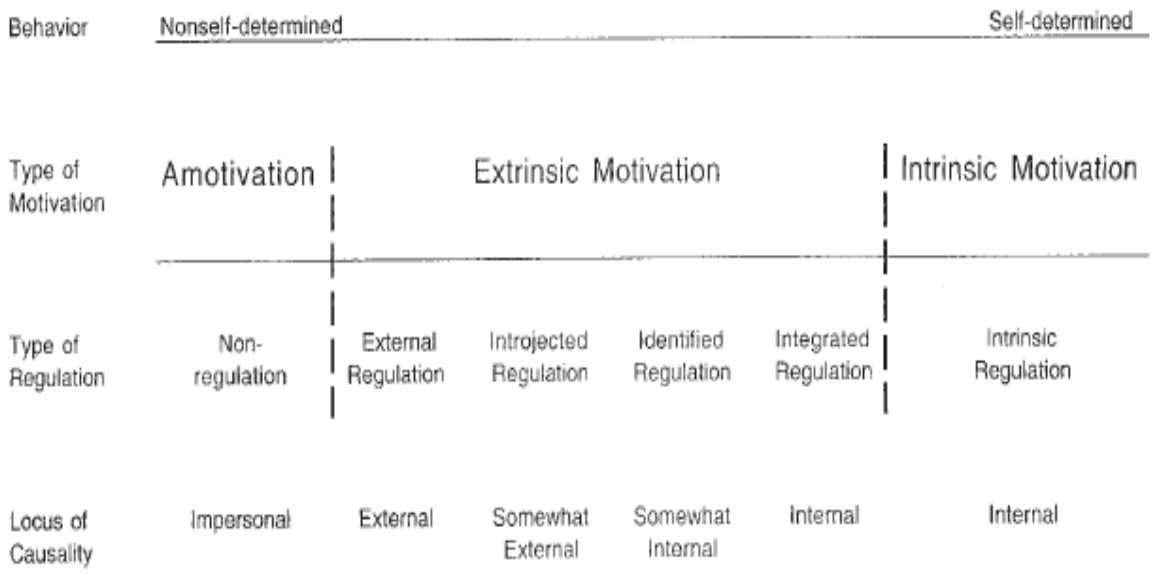

Figure 1. Self-determination continuum showing types of motivation and their corresponding regulatory styles and processes.
Adapted from "The "What" and "Why" of Goal Pursuit: Human Needs and the Self-Determination of Behavior," by E. L. Deci and R. M. Ryan, 2000, Psychological Inquiry, 11(4), p. 237. Copyright by Lawrence Erlbaum Associates, Inc.

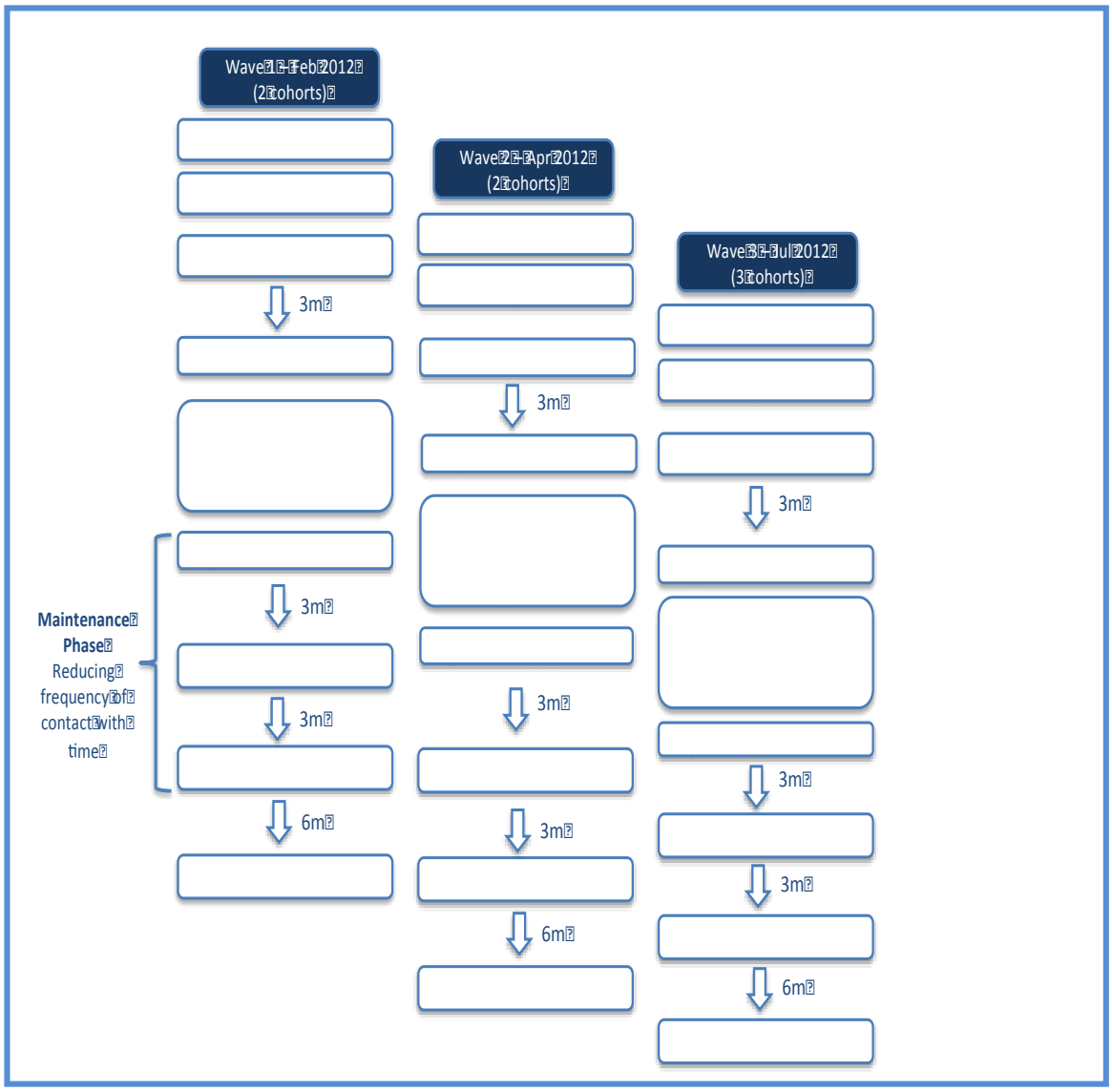

Figure 2. Flow of participants for each cohort wave of the study.
Adapted from "Rationale, Design and Methods for a Staggered-Entry, Waitlist Controlled Clinical Trial of the Impact of a Community-Based, Family-Centred, Multi-disciplinary Program Focussed on Activity, Food and Attitude Habits (Curtin University's Activity, Food and Attitudes Program – CAFAP) Among Overweight and Obese Adolescents," by L. M. Straker, K. L. Smith, A. A. Fenner, D. A. Kerr, A. McManus, M. C. Davis, A. M. Fielding, T. S. Olds, M. S. Hagger, A. J. Smith, R. A. Abbott, 2012, BMC Public Health, 12, p. 7. Copyright 2012 by BioMed Central Ltd.

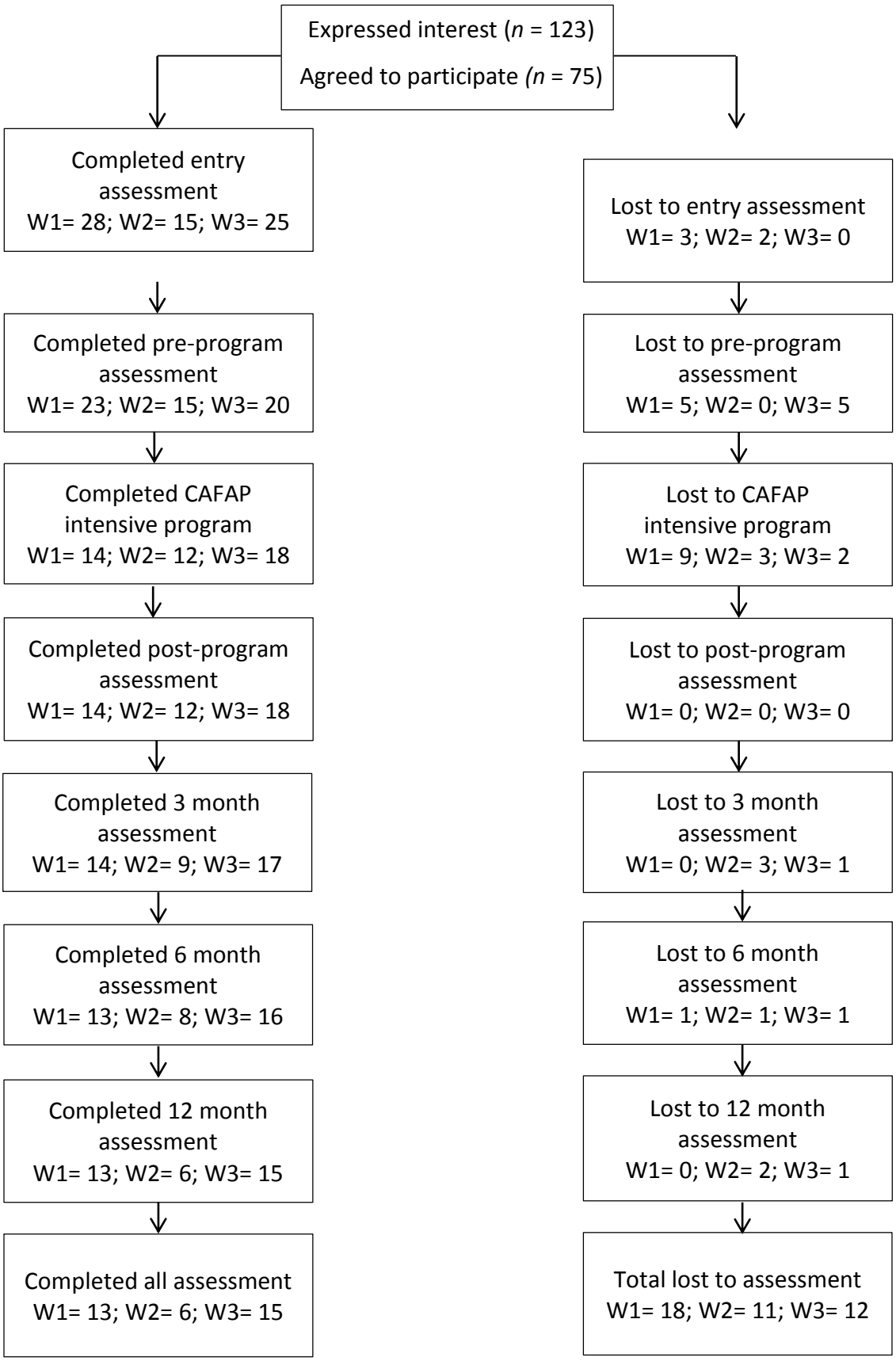

Figure 3. Participant flow chart across assessment periods.

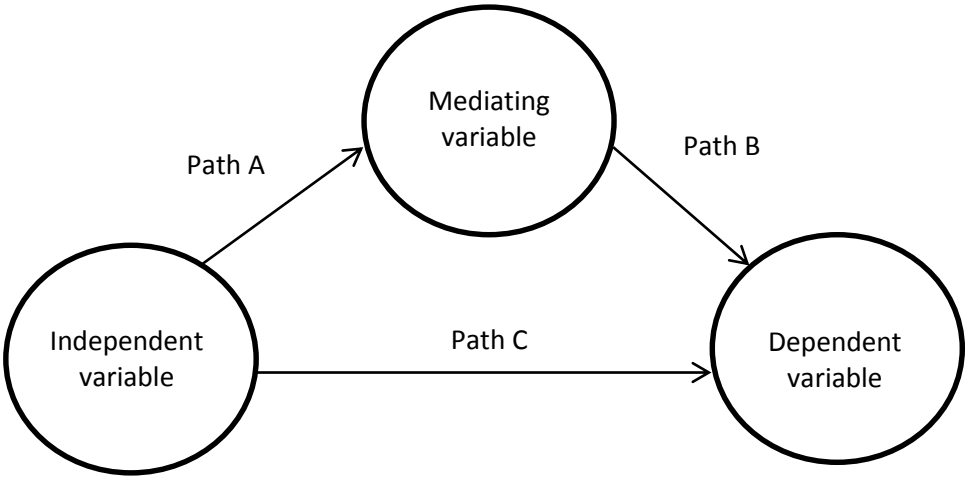

Figure 4. Mediation model used to explore hypothesised relationships related to adolescent outcomes.

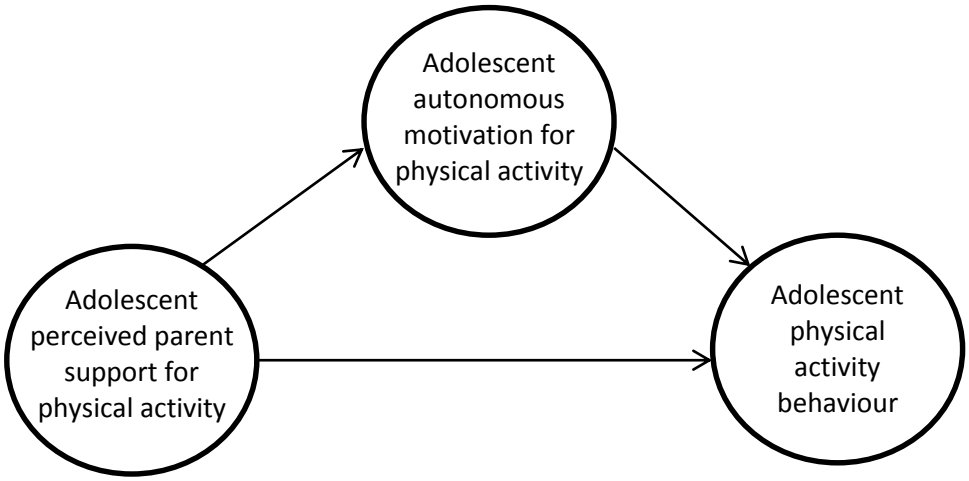

Figure 5. Proposed model used to assess objective 3.1 with regard to physical activity.

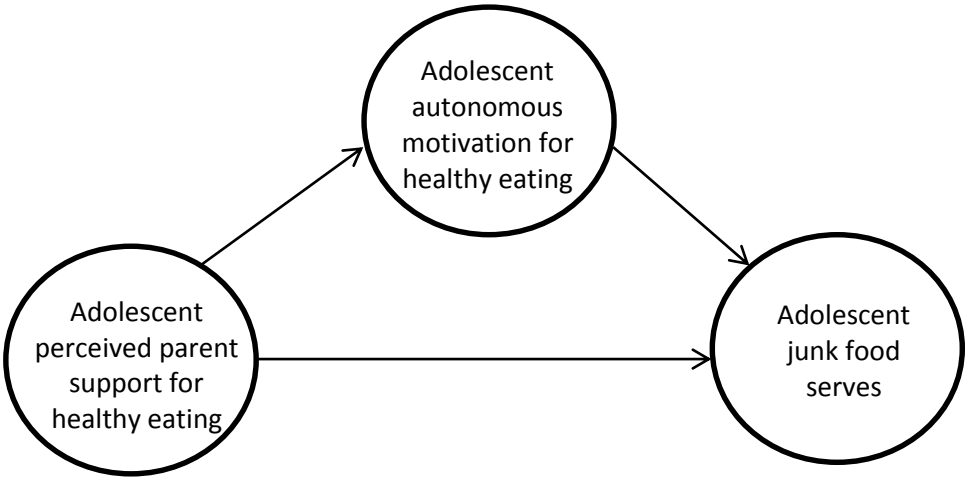

Figure 6. Proposed model used to assess objective 3.2 with regard to junk food serves.

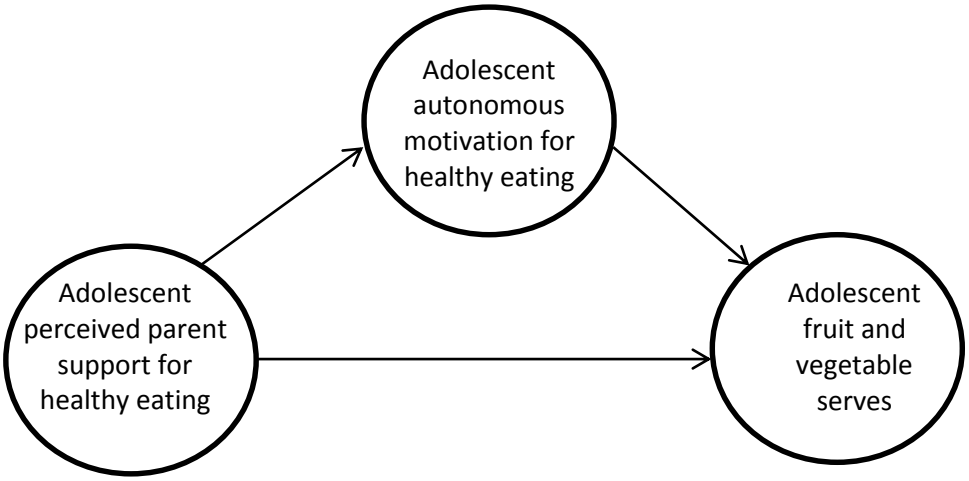

Figure 7. Proposed model used to assess objective 3.2 with regard to fruit and vegetable serves.

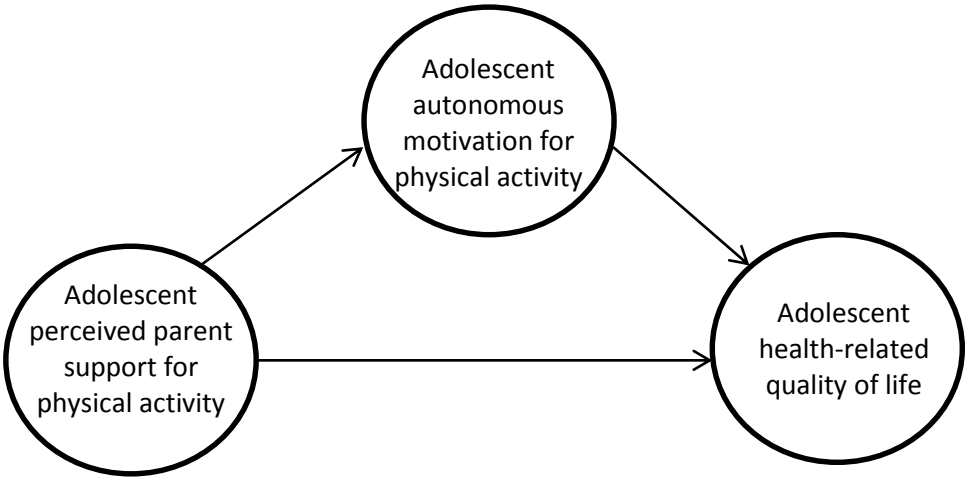

Figure 8. Proposed model used to assess objective 3.3 with regard to physical activity.

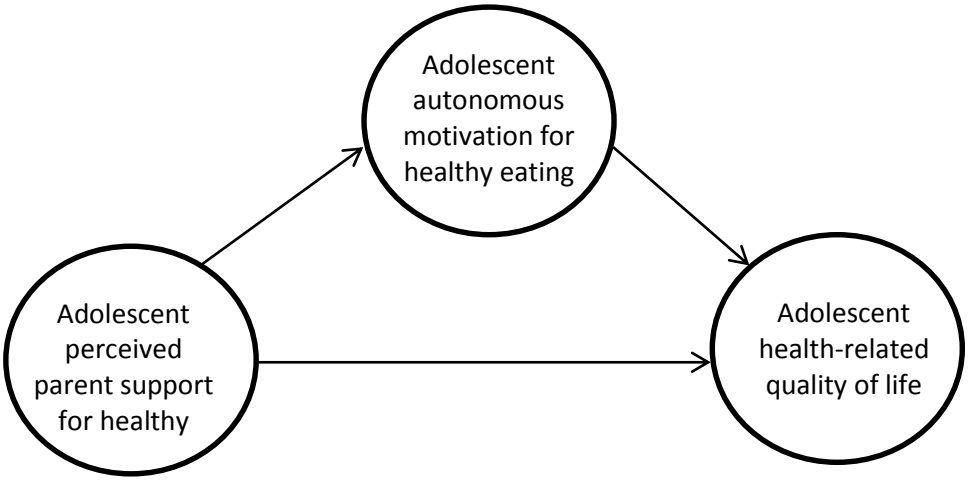

Figure 9. Proposed model used to assess objective 3.3 with regard to healthy eating.

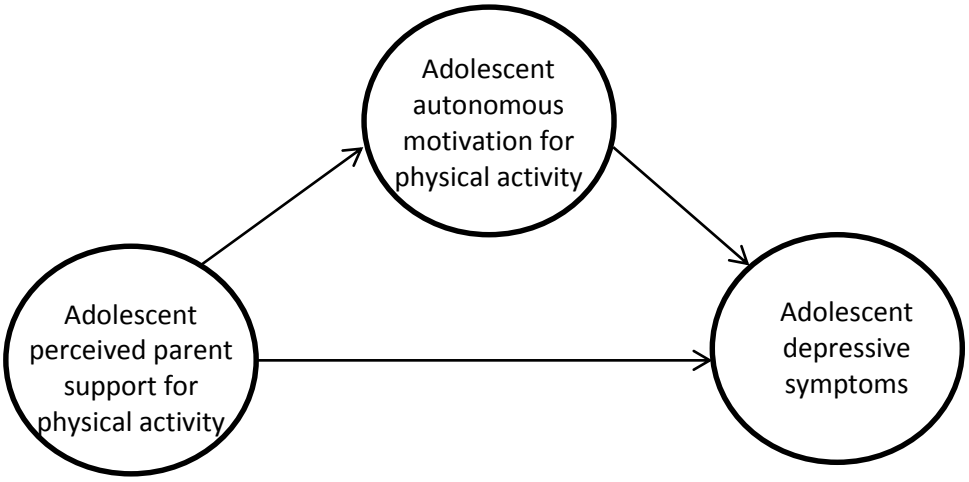

Figure 10. Proposed model used to assess objective 3.4 with regard to physical activity.

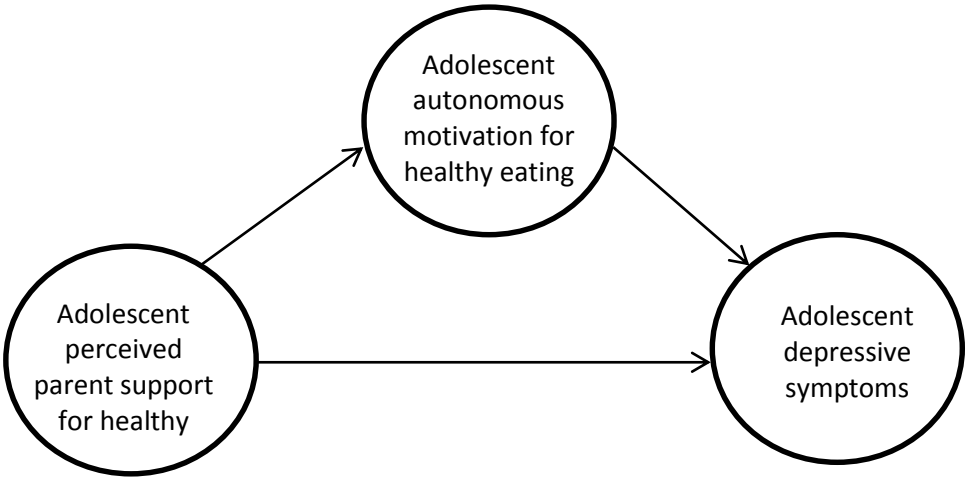

Figure 11. Proposed model used to assess objective 3.4 with regard to healthy eating.

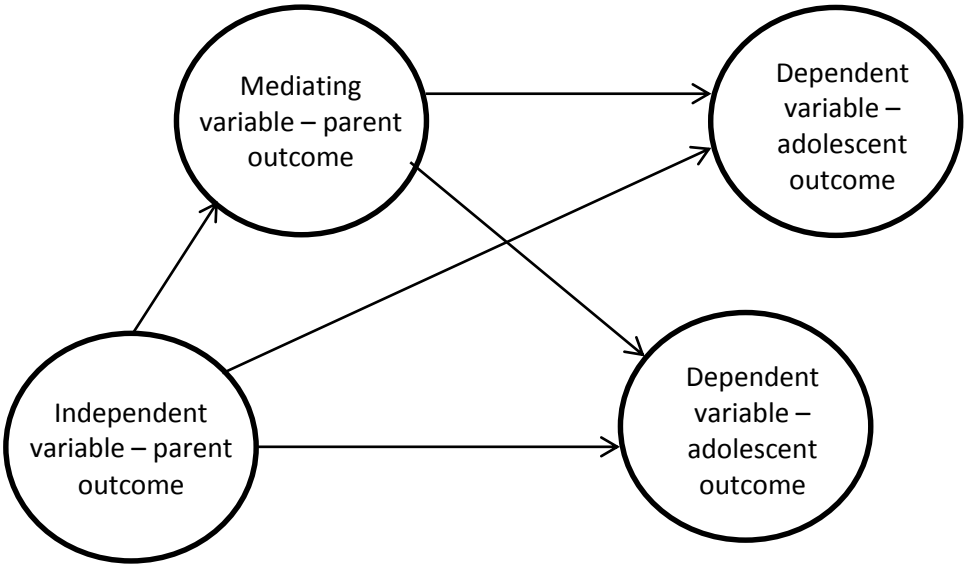

Figure 12. Mediation model used to explore hypothesised relationships related to parent outcomes.

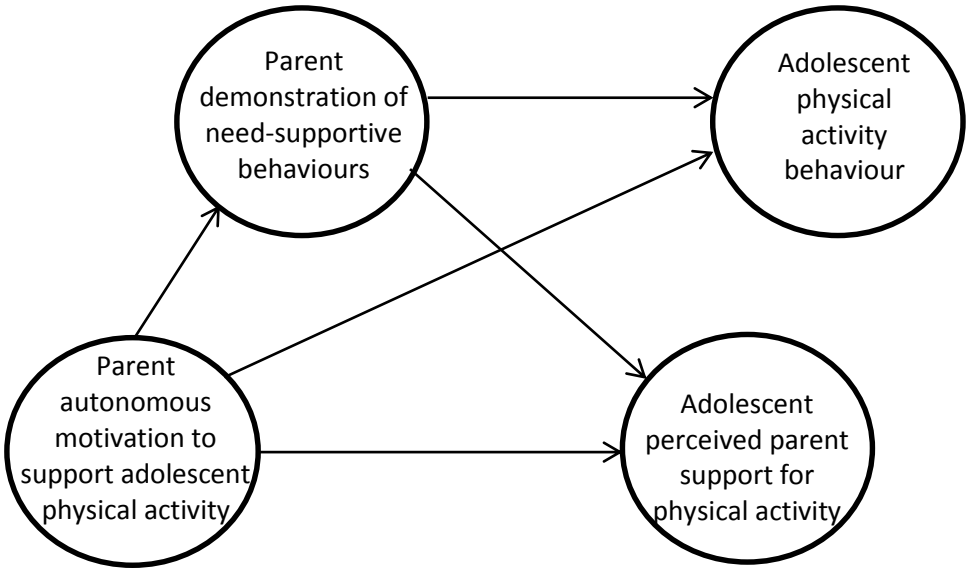

Figure 13. Proposed model used to assess objective 3.5 with regard to physical activity.

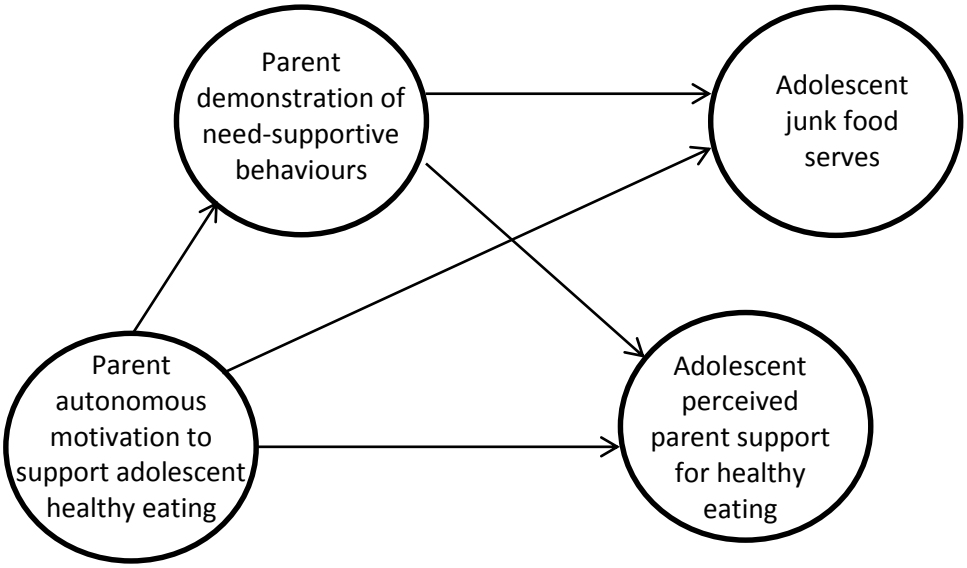

Figure 14. Proposed model used to assess objective 3.6 with regard to junk food serves.

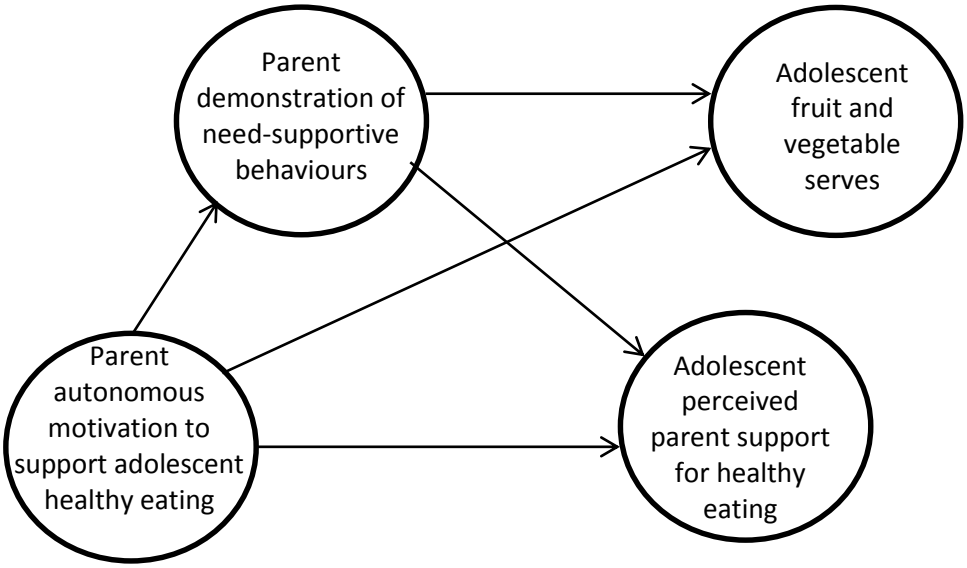

Figure 15. Proposed model used to assess objective 3.6 with regard to fruit and vegetable serves.

Appendix A
Publisher Consent

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Appendix B
Ethics Approval

Curtin University

Memorandum

To	Professor Leon Straker, Director of Research, School of Physiotherapy
From	A/Prof Stephan Millett, Chair, Human Research Ethics Committee
Subject	Protocol Approval **HR 105/2011**
Date	7 September 2011
Copy	Professor Alexandra McManus, CHIRI, Associate Professor Deborah Kerr, School of Public Health, Dr Melissa Davis, School of Psychology and Speech Pathology

Office of Research and Development

Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for your application submitted to the Human Research Ethics Committee (HREC) for the project titled "*Enhancing activity, nutrition and mental health in overweight adolescents: Stage 2*". Your application has been reviewed by the HREC and is **approved**.

- You have ethics clearance to undertake the research as stated in your proposal.
- The approval number for your project is **HR 105/2011.** *Please quote this number in any future correspondence.*
- Approval of this project is for a period of twelve months **06-09-2011** to **06-09-2012**. To renew this approval a completed Form B (attached) must be submitted before the expiry date **06-09-2012**.
- If you are a Higher Degree by Research student, data collection must not begin before your Application for Candidacy is approved by your Faculty Graduate Studies Committee.
- The following standard statement **must be** included in the information sheet to participants:

  This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 105/2011). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

Applicants should note the following:

It is the policy of the HREC to conduct random audits on a percentage of approved projects. These audits may be conducted at any time after the project starts. In cases where the HREC considers that there may be a risk of adverse events, or where participants may be especially vulnerable, the HREC may request the chief investigator to provide an outcomes report, including information on follow-up of participants.

The attached **FORM B** should be completed and returned to the Secretary, HREC, C/- Office of Research & Development:
When the project has finished, or

- If at any time during the twelve months changes/amendments occur, or
- If a serious or unexpected adverse event occurs, or
- 14 days prior to the expiry date if renewal is required.
- An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Yours sincerely,

Associate Professor Stephan Millett
Chair Human Research Ethics Committee

Curtin HREC Form B

Curtin University

PROGRESS REPORT or APPLICATION FOR RENEWAL

The Form B is to be completed and returned to *the Secretary, Human Research Ethics Committee, c/- Office of Research & Development.*

If any of the points below apply prior to the expiry date, this form should be submitted to the Committee at that time. An application for renewal may be made with a **Form B three years** running, after which a 'new' application form, providing comprehensive details, must be submitted.

Approval Number:	HR 105/2011	**Expiry Date** 06/09/12
PROJECT TITLE:	**Enhancing activity, nutrition and mental health in overweight adolescents: Stage 2**	

1A	Has this project been completed?	YES☐	NO☐
1B	OR Do you wish to apply for a renewal of the project?	YES☐	NO☐
If YES please state the expected completion date.		/	
If NO please state why, eg abandoned/withdrawn/no funding etc.			
2	Has this project been modified or changed in any manner that varies from the approved proposal?	YES☐	NO☐
If yes, please provide details_____ *(Attach additional comments on a separate sheet of paper if necessary)*			
3	Have any ethically related issues emerged in regard to this project since you received Ethics' Committee approval? (e.g. breach of confidentiality, harm caused, inadequate consent or disputes on these).	YES☐	NO☐
If yes, please provide details *(Attach additional comments on a separate sheet of paper if necessary)*			
4	Have any ethically related issues in regard to this project been brought to your attention by others? (i.e. study respondents, organisations that have given consent, colleagues, the general community etc).	YES☐	NO☐
If yes, please provide details _____ *(Attach additional comments on a separate sheet of paper if necessary)*			

Investigator:	Prof Leon Straker, Director of Research	Signature:	
Co-Investigator:	Prof Alexandra McManus, A/Prof Deborah Kerr, Dr Melissa Davis	Signature:	
School/Department:	School of Physiotherapy		
Head of Area:		Signature:	
Date:			

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APPROVED: _____ DATE: ____/____/____

Executive Officer

Appendix C
Ethics Amendment Approval

Curtin University

Memorandum

To	Professor Leon Straker, Director of Research, School of Physiotherapy
From	A/Prof Stephan Millett, Chair, Human Research Ethics Committee
Subject	Protocol Approval **HR 105/2011**
Date	7 September 2011
Copy	Professor Alexandra McManus, CHIRI, Associate Professor Deborah Kerr, School of Public Health, Dr Melissa Davis, School of Psychology and Speech Pathology

Office of Research and Development

Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for your application submitted to the Human Research Ethics Committee (HREC) for the project titled "*Enhancing activity, nutrition and mental health in overweight adolescents: Stage 2*". Your application has been reviewed by the HREC and is **approved**.

- You have ethics clearance to undertake the research as stated in your proposal.
- The approval number for your project is **HR 105/2011.** *Please quote this number in any future correspondence.*
- Approval of this project is for a period of twelve months **06-09-2011** to **06-09-2012**. To renew this approval a completed Form B (attached) must be submitted before the expiry date **06-09-2012**.
- If you are a Higher Degree by Research student, data collection must not begin before your Application for Candidacy is approved by your Faculty Graduate Studies Committee.
- The following standard statement **must be** included in the information sheet to participants:

  This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 105/2011). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

Applicants should note the following:

It is the policy of the HREC to conduct random audits on a percentage of approved projects. These audits may be conducted at any time after the project starts. In cases where the HREC considers that there may be a risk of adverse events, or where participants may be especially vulnerable, the HREC may request the chief investigator to provide an outcomes report, including information on follow-up of participants.

The attached **FORM B** should be completed and returned to the Secretary, HREC, C/- Office of Research & Development:
When the project has finished, or

- If at any time during the twelve months changes/amendments occur, or
- If a serious or unexpected adverse event occurs, or
- 14 days prior to the expiry date if renewal is required.
- An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Yours sincerely,

Associate Professor Stephan Millett
Chair Human Research Ethics Committee

Appendix D
First Ethics Renewal Approval

Curtin University

Memorandum

To	Professor Leon Straker, Director of Research, School of Physiotherapy
From	Ms Tammy Rafala, Acting Manager, Ethics
Subject	**PROTOCOL APPROVAL – EXTENSION HR105/2011**
Date	12 September 2012
Copy	Professor Alexandra McManus, CHIRI Associate Professor Deborah Kerr, School of Public Health Dr Melissa Davis, School of Psychology and Speech Pathology

Office of Research and Development
Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for keeping us informed of the progress of your research. The Human Research Ethics Committee acknowledges receipt of your Form B progress report for the project *"Enhancing activity, nutrition and mental health in overweight adolescents: Stage 2."*

Approval for this project is extended for the year to **06/09/2013.**

Your approval number remains **HR105/2011.** Please quote this number in any further correspondence regarding this project.

Please note: An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Yours sincerely,

Rafala

Ms Tammy Rafala
Acting Manager, Ethics
Office of Research and Development

Appendix E
Second Ethics Renewal Approval

Curtin University

Memorandum

To	Professor Leon Straker, Physiotherapy
From	Dr Paul Copland, Manager Research Ethics
Subject	**PROTOCOL APPROVAL – EXTENSION HR105/2011**
Date	5 April 2013
Copy	Professor Alexandra McManus, Centre of Excellence for Science, Seafood & Health; Associate Professor Deborah Kerr, Public Health; Dr Melissa Davis, Psychology and Speech Pathology; Dr Angela Fielding, Occupational Therapy and Social Work; Ms Kyla Smith, Physiotherapy; Dr Emily Ward, Physiotherapy; Dr Anne Smith, Physiotherapy; Professor Tim Olds, University of South Australia, Miss Ashley Fenner, Psychology and Speech Pathology

Office of Research and Development
Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for keeping us informed of the progress of your research. The Human Research Ethics Committee acknowledges receipt of your Form B progress report for the project *"Enhancing activity, nutrition and mental health in overweight adolescents: Stage 2."*

Approval for this project is extended to **06/09/2015.**

Your approval has the following conditions:

(i) Annual progress reports on the project must be submitted to the Ethics Office.

Your approval number remains **HR105/2011.** Please quote this number in any further correspondence regarding this project.

Yours sincerely

Dr Paul Copland
Manager Research Ethics

Appendix F
Participant Information Sheet

Participant Information Sheet

Title: Enhancing activity, nutrition and mental health in overweight adolescents: Stage 2

Name of Investigators: Professor Leon Straker**,** Professor Alexandra McManus, Associate Professor Deborah Kerr, Dr Angela Fielding, Dr Melissa Davis, Dr Emily Ward, Kyla Smith, Ashley Fenner, Dr Anne Smith and Professor Tim Olds

General Purpose, Methods and Demands:
Around a quarter of Australian teenagers are overweight, which increases their risk of poor physical and mental health. Effective programs are urgently needed to help overweight teenagers develop and maintain healthy activity, food and attitude habits.

Curtin University has developed a special program for overweight teenagers and their families. The results from this initial program have reinforced the importance of including activity, food and attitudes components, to help overweight and obese adolescents manage their weight. In Stage 1 of this project, the research team worked with overweight teenagers and their families to find out how to make this program as easy, effective and the results as long lasting, as possible. The program has since been refined and we are now aiming to test whether delivering such a program in local communities can make it more accessible and effective.

Adolescents who are overweight and aged 12-16 years, and their parents/carers, will be invited to participate in this study for about 15 months. (In the description to follow "you" refers to the adolescent participating in the study.) We will ask you to participate in an 8 week program, meeting twice a week for 2 hours duration each time. On each visit you will do exercise in a gym for about 1 hour and in the other hour participate in group sessions focussing on your activity, food and attitudes and your skills related to these. You will be in a group with other adolescents. Your parent will also need to attend at the same time– they will not do the exercises with you but will participate in discussion about the same topics and also gain some related skills. We will also visit you and your parent once at home to discuss how your family works and how you can improve your activity, food and attitude habits.

Three months before you start the program we will measure your activity habits, fitness, food habits and attitudes. We will measure these again just before the program starts, at the end of the program and 3, 6 and 12 months after the program.

To measure your activity we will ask you some questions in a questionnaire and ask you to wear an activity monitor (looks like a watch) on a strap around your waist for a week. To

measure your heart and lung fitness we will ask you to run up and down a 10 metre track. To measure your strength we will ask you to bend your knee, bend your elbow and raise your arm while we measure how much force you can push with. To measure your leg muscle power we will ask you to jump as high as you can. To measure your body we will measure your height, weight and waist circumference. To measure your food habits we will ask you to keep a diary of everything you eat and drink for 3 days and fill in a short questionnaire. To measure your attitudes we will ask you to fill in some questions about your feelings. All this measurement will take about 2 hours each time. If you answer the questions at home in your own time, the measurements will take less than an hour. We will also ask your parent/guardian to complete some of their own forms.

Risks, Discomforts and Benefits:
You will only participate if you and your parent are satisfied that you both understand the purpose of the research, what is expected of you and the risks, discomforts and benefits of the study. You and your parent will be asked to sign a form declaring you are willing to participate. You should not feel discomfort at any point in this research.

There are a number of potential risks you need to understand. You may injure yourself doing the exercises in the gym, or doing other physical activity at home. We will teach you how to exercise properly so you have very little risk of injury. Having your body measured can be a bit embarrassing. We will measure you on your own, not in a group, to minimise this. Thinking and talking about how you feel can be upsetting. We will provide support to you in the group and can arrange individual discussions with you. If assessments or group participation identify a physical or mental health problem we will discuss this with you and your parent to provide information about appropriate support.

Participation in this study will have direct benefits for you. The assessments will give you a clear picture of what your current activity, food and attitude habits are. The discussions will give you a good understanding of how to change these habits to improve your health and happiness. The exercise skills and other skills you learn will be useful to you for the rest of life. Applying the skills and knowledge will lead to improved health for you and a lower risk of health problems.

There will also be benefits to others. Once we have tested this program and possibly refined it based on your feedback, we will try to make the program available to other adolescents across Western Australia. We will also present what we have learned about the program at scientific conferences and publish the results in scientific journals. This will help others provide successful programs for overweight adolescents across Australia and the world.

Confidentiality:
All information provided by you will be confidential. Your identity will not be disclosed in any published material resulting from the study, unless you have given separate consent for public use of any images.

Request for more information:

You and your parents are encouraged to discuss any concerns you have regarding the study with study staff at any time. If you would like, we can send you a copy of the summary of the study when we have analysed all the results.

Consent to Participate:
If you decide to participate in this study after considering this information, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without discrimination, judgment or penalty.

Further Information:
If you have any further queries, please don't hesitate to contact Professor Leon Straker on 92663634 or l.straker@curtin.edu.au

This study has been approved by the Curtin University Human Research Ethics Committee (Approval number HR105/2011). The committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth WA 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au

Thank you very much for your involvement in this research, your participation is greatly appreciated and will help improve the health of Australian teenagers.

Appendix G
Participant Consent/Assent Form

Participant Consent/Assent Form

Title: Enhancing activity, nutrition and mental health in overweight adolescents: Stage 2

Name of Investigators: Professor Leon Straker**,** Professor Alexandra McManus, Associate Professor Deborah Kerr, Dr Angela Fielding, Dr Melissa Davis, Dr Emily Ward, Kyla Smith, Ashley Fenner, Dr Anne Smith and Professor Tim Olds

I have read the information on the Participant Information Sheet. Any questions I have asked have been answered to my satisfaction. I agree to allow my child to participate/to participate in this research but understand that my child and I can change my mind and stop at any time. I understand that all information provided is treated as confidential. I agree that research gathered for this study may be published, provided names or any other information that may identify my child/me is not used.

- I understand the purpose and procedures of the study.
- I have been provided with the participant information sheet.
- I understand that my involvement is voluntary and I can withdraw at any time without prejudice.
- I understand that no personal identifying information like my name and address will be used and that all information will be securely stored for 7 years before being destroyed.
- I have been given the opportunity to ask questions.
- Parent – I consent to my child participating and to participating myself in the study outlined to me.
- Teenager – I assent to participate in the study outlined to me.

_____ _____
Parent/guardian Date

_____ _____
Participant (teenager) Date

_____ _____
Investigator Date

Appendix H
Protocol for Behavioural Incident

Protocol for Behavioural Incident

The following protocol has been written to provide guidelines to facilitators on appropriate measures to use in the event that there is an escalation in behaviour during group sessions in the Curtin Adolescents Food and Activities Programme (CAFAP). The paper outlines de-escalation techniques to manage aggressive behaviour/conflicts within group members. In the event that a group member is noted to become increasingly agitated, or it is assessed that a situation/group discussion is increasing in intensity, or a conflict has arisen between group members, follow the 10 critical de-escalation skills listed below.

As much as possible, we would not want a situation to reach a stage where de-escalation is needed. Many incidents of anger/conflict could be prevented if those who are around a person about to become angry notice the subtle change in the person's behaviour. Quiet people may become agitated; while louder, more outgoing people generally become quiet and introspective. Listed below are some **early warning signs** to take note of:-

Clenched fists
Clenched jaw
Rigid posture
Tautness indicating intense effort to control emotions
Agitation
Increasing motor activity
Hostile threatening verbalisations
Provocative behaviour
Argumentative
Dissatisfied
Over-reactive
Hypersensitive

Paying attention to these subtle changes and simply commenting on the change could help the individual talk about things so he or she wouldn't have to become angry. However, there still will be times when you don't notice the early warning signs or when your first encounter with the person occurs when they are already in an angry state. Also, it's possible that you will do everything right in this prevention phase and angry people will still choose anger as their best chance for getting what they want. When any of these situations occur, you will need to de-escalate the individual.

The main objective of de-escalation is to reduce the level of arousal so that discussion becomes possible. In order to do this, remember these points:-

1. **Appear calm**, centred and self-assured even if you don't feel it. Relax facial muscles and look confident. Anxiety can make the individual feel anxious and unsafe which can escalate aggression. Use a modulated, **low monotonous tone of voice** (our normal tendency is to have a high pitched tight voice when scared). If necessary, remove the individual from the group and speak to them in a private space.
2. **Never turn your back** for any reason. Ensure that there is a way of escaping (stand closest to the door/escape route). Always be at the same eye level. Encourage the individual to be seated, but if he/she needs to stand, you stand up also. Stand at an angle so you can sidestep away if needed. Do not maintain constant eye contact. Allow the individual to break his/her gaze and look away.
3. Employ **active listening** strategies - hear, acknowledge and understand what the person is saying. Attend not only to the words the person is saying but also the underlying emotion, as well as, the accompanying body language. By simply providing a sounding board and a willing ear, a person's anger can be dissipated.
4. Wherever possible, tap into the individual's cognitive mode (e.g., "**Help me to understand what is going on for you**"). Getting them to explain the situation to you and making you understand takes the focus away from their emotional response.
5. If deemed appropriate, **acknowledge the emotion** underlying the words a person is using but DO NOT ask "Tell me how you feel"! (Instead it is more appropriate to state, "I understand that you have every right to feel angry.") By acknowledging and really trying to understand what the angry person is feeling, that person becomes able to release a lot of the aggression.
6. **Agree with** the grain of truth in what they are saying - often when people are angry about something, there is at least 2 % truth in what they are saying. When attempting to diffuse the individual's anger, it is important to find that 2 % of truth and agree with it. When someone is angry and you attempt to reason with the person, your efforts will be largely ineffective. When you agree with the 2% of truth in the angry person's tirade, you take away the resistance and consequently eliminate the fuel for the fire.
7. It may be **useful to apologise** – not for an imaginary wrong but sincerely apologising for anything in the situation that was unjust. It's simply a statement acknowledging that something occurred that wasn't right or fair. This can have the effect of letting the individual know that you are sincerely sorry for what they are going through and they may cease to direct their anger at you. Remember that the point of de-escalation is to calmly bring the level of arousal down to a safer place.
8. **Explain limits and rules** in an authoritative, firm, but always respectful tone. Give **choices** where possible in which **both** alternatives are safe ones (e.g., "Would you like to continue in the group session or would you prefer to stop now and come back next week when things can be more relaxed?")

9. Remember that reasoning is not possible with an enraged person. Instead, **arrange** to meet/follow up on the incident at **another time** when the individual is composed and the matter can be objectively and fairly resolved.
10. Finally, **trust your instincts**! If you assess or feel that de-escalation is not working, STOP! You will know within 2 or 3 minutes if it's beginning to work. Tell the person to leave, escort him/her to the door, call for help or remove yourself from the situation and call the police.

It is also important to note that other group members may be traumatised by the incident and it is **important to debrief with the group** and address the effects on them. If some of the group members are too shaky, arrange for their parents to pick them up. Provide a debriefing session for the parents to address their concerns and provide information on how the matter is being resolved.

Adapted from the following sources:

http://kimolver.articlealley.com/ten-critical-deescalation-skills-12898.html

http://www.nursing.health.wa.gov.au/docs/career/np/NMAHS/SCGH_Aggression.pdf

http://www.naswma.org/displaycommon.cfm?an=1&subarticlenbr=290

http://www.oxfordshirepct.nhs.uk/about-us/documents/265HealthandSafetyManagementofViolenceandAggressionPolicyApril2011.pdf

Appendix I
Recruitment Flyer

TEENS WANTED TO GET FIT, GAIN ENERGY AND LOSE WEIGHT

The Curtin University Activity, Food and Attitudes Program (CAFAP) is a free eight-week healthy lifestyle program for 12 to 16 year olds that includes families in the approach to changing lifestyles and creating healthy lifelong habits.

18-year-old Jessica Blackburn, pictured, a former participant in the holistic health program, saw great results in just two months.

"I went from a size 18 to a size 12. I felt down and lacking in confidence, but now I'm happy and have lots of self-belief."

To participate teens need to be overweight and aged between 12 to 16. Parents will need to attend classes with their children attending two-hourly sessions after school hours twice weekly for eight weeks.

Places are limited so register your interest now for a program near you.

Make tomorrow better.

Telephone Kyla or Debbie 9266 3694
Email cafap@curtin.edu.au or visit cafap.curtin.edu.au

GEON047633

Appendix J
Instructor Manual – Session Five and Session Six (Adolescents)

Week 3, Session 5, 2nd hour. Adolescents.
Learning to set goals and feedback. Lead by psychologist.

Activity	Description	Time	Materials required
Introduction	Facilitator explains session purpose. Adolescents receive feedback about their food intake and activity levels from before the program. Adolescents will learn about goal setting and then set overall goals for each behavior and weekly goals for sedentary behavior.	1 min	
Activity and eating feedback and overall goal setting.	Provide feedback on current activity levels (based on assessment pre-program) and ask adolescents to confirm their current levels. Use this data to set overall program goals.	30 mins	*CAFAP goal setting book*
Introduce weekly goal setting concepts and set weekly goals for sedentary behavior	Adolescents learn concepts for setting weekly goals. Facilitator to run through a weekly example of sedentary behavior goals, using worksheets to illustrate key points. Adolescents to set weekly goals for sedentary behaviors (complete physical activity and healthy eating in session 6).	29 mins	*Example teenager weekly goals for sedentary behavior* *CAFAP goal setting booklet* *Carbon paper*

*Throughout this session participants are to be reminded that the feedback is to help the teenagers set goals, and that there is no right or wrong feedback

Session Goals: At the end of this session, participants will be able to:
- Identify their current level of activity
- Identify their current level of inactivity
- Identify their current intake of fruit, vegetables and junk food
- Identify their current eating behaviors
- Set clear and defined overall goals (physical activity, sedentary behavior, and healthy eating) and weekly goals for sedentary behavior.

******BEFORE THE SESSION******

Record participant names (pen) on each booklet and the corresponding baseline data (in pencil) in the overall goals matrix in their goal setting booklet by putting a square around their baseline activity levels.

INTRODUCTION (~1 min)

- Looking at your current physical activity, sedentary behavior, and eating status (from baseline assessments)
- Setting goals to achieve by the end of the program for each of these behaviors.
- Goal setting is a useful strategy that lots of people use to help them change or adjust their physical activity and healthy eating behaviors.

ACTIVITY AND EATING FEEDBACK AND OVERALL GOAL SETTING
(~30 mins)

Give each participant their own CAFAP goal setting booklet

Booklets are individualized. Ask participants open the second page of their booklet showing their overall goal matrix. Explain the following:

- Square placed around their current activity levels based on information collected in the assessments before the program started
- Area in grey indicates national average
- Area on far right (sore of 10) are the recommended guidelines

Take participants through each behavior individually. Ask participants to do the following:

- Look at behavior squared. If you think that your actual behavior is different, then put a square around that amount (monitor responses as there should be little changes required).
- Remind participants how each behavior is defined – they may refer to the back of the sheet for conversions.

Once teenagers have decided on their current levels (e.g., square around each behaviour) ask them to set overall program goals:

- Based on your current levels we'll work on setting goals for you to achieve by the end of the program in 4 weeks' time.
    - These goals will be broken down into smaller more manageable goals to achieve each week. So think about what goal you think you can work toward each week to reach in four weeks.
    - Try to set realistic goals that are challenging, but not extremely difficult, or too easy. Setting challenging goals will help you stay motivated, ultimately helping you reach your goal behaviors.
    - Moving a single score, for example from 1 (MVPA: 10mins 3 x wk) to 2 (MVPA: 20mins 3 x wk) will result in a significant improvement in your health.
    - Once teenagers reach their overall program goals, they can set new goals to reach in three, six, and twelve months' time.

- Don't have to necessarily have to try to reach the optimal recommendations for each area by the end of the program, because even small improvement of moving to the next score will result in big improvements to your health and physical fitness. As well, each score level you reach will make it easier for you to reach the next level up.

INTRODUCE WEEKLY GOAL SETTING CONCEPTS AND SET WEKELY GOALS FOR SEDENTARY BEHAVIOR (~29 mins)

Explain purpose of weekly goal setting:

- Provides a structure for reaching your overall goals
- Help provide a plan for how to achieve the behaviors you want to change
- Writing a concrete plan will help you regularly check your progress, which helps you see if you've achieved your goals and helps when you set new goals to achieve
- Breaking your overall program goals into smaller goals will help you have more manageable goals. This helps you to easily review your progress and you can use this feedback to set new goals. Smaller goals make it easier to achieve your goals, which helps build confidence, ultimately help you to reach your overall program goal.
- To help achieve your goals, each week we'll work with you to set goals, and then get your parents to work with you to set goals for behaviors they can do to support the behavior change goals you choose.

Explain goals teenagers should try to set each week. Explain that setting these types of goals makes it more likely that they will reach the goals they set to improve their health and physical fitness:

- **Challenging**: helps ensure your goal isn't "too easy" or "too difficult/impossible", which helps you stay motivated to achieve your goals and to continue working toward higher goals. Each week, we'll get you to check how challenging your goals are by rating it on a scale of 0 to 10 with 10 being impossible and 0 being too easy.
- **Specific**: Helps you know what behaviors to work toward, which helps you see the progress you've made vs. vague goals (e.g., I want to be healthy).
    - We'll work together to record specific behaviors to work toward each day.
- **Reasons**:
    - What do you want to happen by reaching your goal?
        - Try to think of reasons related to improving your health and physical fitness and limit reasons related to appearance. If you think about and visualize your reasons for setting a goal, you are more likely to be motivated and achieve your goal, particularly when your reasons relate to your health and physical fitness that you can personally measure, instead of things that others judge you on such as your appearance. When you feel less motivated, try to think about reasons related to your health to help you keep working towards your goal.
    - Why is this important that you achieve this goal?
        - Try to think of reasons related to your enjoyment and values and limit reasons related to things you feel forced to do by your parent or doctor. Thinking about and visualizing reasons for goal setting that

related to outcomes you value, will help you reach your goals. When feeling less motivated, try to think about reasons for reaching your goals that related to things you enjoy and value.

The types of goals to set are outlined in your goal booklet (show page).

Lead example – overall goals into weekly goal (sedentary behavior):
Read aloud: *If an adolescent currently has 3.5 hours of sedentary behavior each day, and they want to have a maximum of 3 hours by the end of the program, where should they set their goal for the first week? (write baseline levels and program goals on whiteboard).*

Ask teenagers to work in pairs to come up with what they think a good goal is for the first week, then discuss responses as a group. Write first weeks' goal on whiteboard. Ask teenagers to rate how challenging the goal is (0 to 10) and ensure it is around a 6-8.

Ask teenagers to work in pairs to come up with reasons for setting this goal. Write these reasons on the whiteboard.

- What do you want to happen by achieving the goal _____
- Why is it important you achieve this goal _____

Goal behavior examples can be used to help come up with activities to help reach your goals. Example of weekly goals (how it might look) is also included in the goal setting booklet.
Work as a whole group to come up with ways they can reach the example teenager's goal. Suggest they come up with additional ideas and write these on their goal behavior examples. Write on whiteboard how their goal behaviors fit in to each day of the week (e.g., Monday video games 4.00 to 6.00 and 7.00 to 8.00, Tuesday Simpsons and Glee, Wednesday computer games 6.00 to 8.00, etc.). Encourage teens to list the names of the TV shows they might watch and/or the specific times when they plan to be on the computer or play video games – choose whichever way works best. Remind teens that by putting times on things it might make it easier to remember the maximum amount of time to spend in each behavior.

Refer teens to example of sedentary behavior in their goal setting booklet.

Use overall goals and weekly goals in goal setting booklet.

Record on carbon paper

Take teenagers through setting their own sedentary behavior goals. Follow steps used in example above (listed below):

- Review current behavior levels and overall goals
- Break overall goal into first week goal and record this goal on their weekly goal sheet (point to area)
- List reasons (why and what), remind teenagers to think of reasons:
    - Related to improving your health and physical fitness and limit reasons related to appearance

    - Related to your enjoyment and values and limit reasons related to things you feel forced to do by your parent or doctor
- List daily behaviors, including times for sedentary behavior. May refer to example behavior sheet and come up with their own reasons, the choice is up to them.
- Record challenge rating for the goal (0 – 10). Check rating is between 6–8.

Tomorrow, you can start working toward your weekly goal for sedentary behaviour. Next session we'll work together to set goals for your physical activity and healthy eating behaviours.

Session conclusion

- Overall program goals are set – can use these strategies at the end of the program to set their long-term goals over the one year follow-up period
- Set weekly sedentary behavior goals
- Think about weekly goals they want to set next session for physical activity and healthy eating

Week 3, Session 6, 2nd hour. Adolescents initially then joined by parents. Setting goals. Lead by psychologist.

Activity	Description	Time	Materials required
Introduction for adolescents	Explain that adolescents will be setting their weekly goals then sharing their overall and weekly goals with parents to help them set support goals.	2 mins	*Instructor manual*
Adolescents set weekly goals for physical activity and healthy eating	Adolescents set their weekly goals for physical activity and healthy eating. Instructors move between adolescents to help them set goals.	25 mins	*Adolescent CAFAP goal setting booklet* *Carbon paper*
Introduction for parents	Explain that parents will be copying adolescent overall program and setting their own weekly goals in discussion with adolescents.	2 mins	*Instructor manual*
Parents copy teens' overall goals	Adolescents share overall goals with parents and parents copy these into their booklets.	5 mins	*Adolescent CAFAP goal setting booklet* *Parent CAFAP goal setting booklet*
Parents set weekly goals	Parents and adolescents work together to help parents set their weekly support goals. Instructors move between families to help them set goals.	25 mins	*Adolescent CAFAP goal setting booklet* *Parent CAFAP goal setting booklet* *Carbon paper*

Session Goals:

- Teens set weekly goals for physical activity and healthy eating.
- Parents copy teens' overall goals.
- Parents set weekly goals for supporting teens' physical activity, healthy eating, sedentary behavior.

INTRODUCTION (~2 mins)
Today you will get the opportunity to:

- Set weekly goals for your physical activity and healthy eating
- Share your overall and weekly goals (sedentary behavior, physical activity, healthy eating) with your parents to help them set goals to support the goals you've chosen to improve your health and physical fitness

TEENAGERS SET WEEKLY GOALS – PA AND HE (~20 mins)

Give each teenager their own goal setting booklet

Record on carbon paper

Discuss how teenagers went with their sedentary behavior goals. Encourage teens to use that information when setting their weekly and physical activity goals (these goals will be set on a Thursday and reviewed on a Monday – don't need to set PA and HE goals for Tue and Wed).

Take teenagers through setting their own physical activity weekly goal:

- Review current behavior levels and overall goals
- Break overall goal into first week goal and record this goal on their weekly goal sheet (point to area)
- Record challenge rating (0 too easy and 10 impossible)
- List reasons (why and what), remind teenagers to think of reasons:
    - Related to improving your health and physical fitness and limit reasons related to appearance
    - Related to your enjoyment and values and limit reasons related to things you feel forced to do by your parent or doctor
- List daily behaviors, including times for physical activity (if possible). May refer to example behavior sheet and come up with their own reasons, the choice is up to them.

Take teenagers through setting their own healthy eating weekly goal (steps as per above). Remind teens to list how many serves per day (e.g., Veg 2 ≥ s/2 days a week means 2 serves of veg 2 days of the week).

After goals are set explain:
Parents will be brought into the room so that you can tell them what your overall program goals are, and the weekly goals you've set to reach in one weeks' time. By sharing your goals with your parents, they'll know what you're working toward and you can then help them set goals for behaviors they can do to help you reach your goals.

******ONCE ALL TEENS HAVE FINISHED SETTING GOALS, PSYCH IMMEDIATELY COLLECTS PARENTS FROM THE PHYSIO (e.g., psych interrupts session) AND BRINGS THEM IN TO SET GOALS WITH TEENS******

PARENTS SET GOALS (intro: 2 mins, overall: 5 mins, weekl: 25 mins)

Introduction (~2 mins):

- Teens share overall goals with parents and parents record these goals
- Teens share weekly goals with parents to help them set goals to support the goals you've chosen to improve your health and physical fitness
- Parents set weekly to support teens' goals in discussion with their teen

Give each parent a goal setting booklet

OVERALL GOALS (~5 mins)

Parents and teens turn to overall goal matrix in their respective booklets. Lead teens through sharing their goals with parents:

- Explain this will help parents see where the teen is and where they'd like to be so they can set goals to support these goal behaviors
- Parents circle teens' current levels (square) and overall goals (circle)

WEEKLY GOALS (~25 mins)

Record on carbon paper

Parents and teens turn to first weekly goals sheet in their respective booklet. Teens share weekly goals with parents. Guide through sharing, one behavior at a time:

1. Physical activity
    - Weekly goal: Adolescent tells parent their weekly goal, parent writes their support weekly goal in their booklet by recording the teen's weekly goal next to the words "My goal this week is to support my teen's goal of".
    - Parents list reasons (what they want to happen and why it is important): Tell parents: *remember to think of reasons related to improving teenagers' health and your values/enjoyment, and limit reasons related to your teenagers' appearance and what others have told you to do that you don't necessarily value*.
    - Daily details: Adolescents share their daily details. Parents list behavior goals that map onto behaviors teenagers have listed (may not be one listed for each day if teenager doesn't need support, e.g., they have listed a school activity)
    - Parents record challenge rating (0 to 10) next to each daily goal behavior.

2. Sedentary behavior
    - Steps as above

3. Healthy eating
    - Steps as above

Take home information:

- Booklets remain with instructor: We ask that the booklets remain here so that way you'll always have something to review and use the following week, without having to worry about keeping track of your booklet each time you come to a session.

- Carbon copy: We also want you to know what your goals are when you're at home to make it easier for you to reach your goals each week, which is why we're asking you to take the carbon copy home.

Keep your goal sheet in your clipboard but put it somewhere at home that you can check in and see how you are going each day. When you look at it each day you can put a tick next to your daily detail if you achieved it. This will help you rate your progress in the next session

Session conclusion

Today you have set important goals for how you can be happier and healthier. Look at your goal sheets each day to keep a check on how you are going.

If you are struggling a bit to be motivated- which might happen- look at your reasons for setting your goals, and parents and teens, remember to support each other.

Remember to bring back your clipboards with the goal sheets next week!

Week 8, Session 15, 1st hour. Adolescents
Final Goals Review. Lead by Physiotherapist.

Activity	Description	Time	Materials required
Exercise	Short, intense session	55 mins	
End of Program Goals Review	Review goals for program to date and rate progress	5 mins	Adolescent CAFAP goal setting booklet

Session Goals: At the end of this session, participants will be able to:

- Review progress on overall goals

Weekly goals review by teens (5 mins)

Hand out participants' goal booklet from last week.

- Check how they went last week
- Each teenager to go through each goal and each day of the week- tick if achieved (steps and daily activities).
- Rate <u>weekly</u> progress towards each of the 3 goals?
    - at the top of the page under each goal 'weekly progress'
    - 0 for didn't achieve it at all, 5 for achieved half of it and 10 for achieved all of it
- Rate your progress towards <u>overall</u> goals
    - From matrix

Week 8, Session 15, 2nd hour. Adolescents and Parents.
Final Goals Review. Lead by Psychologist. Other facilitators to help with goal setting.

Activity	Description	Time	Materials required
Three month goal setting	Set goals for follow-up period	15 mins teens only Parents join for last 45 mins	Adolescent CAFAP 3 month goal setting booklet Parent CAFAP 3 month goal setting booklet

Session Goals: At the end of this session, participants will be able to:

- Review progress on overall goals
- Set goals for 3 month follow-up

Hand out teenager 'Adolescent 3 month goal setting booklet', carbon paper and blank sheet

Get the teenager to write their name on the front of the booklet immediately.

Teenager Overall Goals for 3 months time

- Turn to the "teenager overall goals page" which shows the CAFAP habits matrix example.
- Remind teens that numbers on far right are recommendations/guidelines and shaded grey box is Australian average
- Explain that you mark where you are now with a square and where you want to be in 3 months time with a circle.
- Goal may be to stay where you are (ie/ maintenance of change you've already made) so square and circle would be at same place.
- Even keeping up with small improvements in your habits → healthier and happier.
- Now turn to blank matrix

For each healthy habit:

- Put a square around where you are now (based on last weeks goals)
- Put a circle around where you want to be in 3 months time (new goal)

For healthy eating:

- Remember, this is an average of fruit consumed.
- 0.5 doesn't necessarily mean you are consuming half a piece of fruit each day, it may mean that every other day you eat a piece of fruit
- Refer to the front of your goal setting booklet (helpful hints page) to help remember what a serving of fruit is equal to.

Teenager Weekly Goals

Just like the overall goals you set to achieve by the end of CAFAP, the overall goals you set to achieve by the end of three months can be broken down into smaller weekly goals to help you reach your overall goals.

Work through each of the 3 areas (use carbon paper and keep the 2nd copy for CAFAP team)

- Think about how you went last week
- Think about how to get to your overall 3 month goal
- Write in your goal for this <u>week</u>
- Make sure the carbon paper and blank sheet are underneath your goals sheet!
- Write in your reasons- try to make them about things that are important to you (not others) and for your health (not appearance)
- Write in your challenge score for each activity
    - remember too little or too much challenge won't work – just the right amount of challenge!

Move around the groups and help them to set goals

When they are done, get the dietitian and parents to join them. Dietitian will have prepped parents about 3 month goals and they have their own booklets.

Parents Setting Goals for the next 3 months

Parents - In your new 3 month goal setting booklet, turn to the sheet that is the summary of your teens overall goals.

Teenagers – share where you are now (squares) and where you would like to be in 3 months time (circles) with your parent.

Parents - copy where your teen says they are now (square) and were they would like to be in 3 months (circle).

Work together to set parent weekly goals.
Teens tell your parents what your weekly goal is.
Parents and teens discuss how parents can support you during the week
Work through each of the 3 areas.

Parents, make sure you write in why it is important to you to support your teens goals. Remember, you are more likely to be motivated and achieve your goal when your reasons relate to supporting your teen's health and physical fitness that you can personally measure, instead of things that others judge such as your teen's appearance.

Once completed- take a photo (on your phone) of teens goal matrix page and the carbon copy of the first weekly goals page (with teens name on)– to come back to CAFAP team to help know what to be supporting in maintenance phase

Session Conclusion
Everyone can be really proud of the successes you have had in progressing towards your goals. After the next session we won't see you for 3 months, but the CAFAP team will be in regular contact with you. With support from us, your family and yourself you can look forward to acheiving your goals and being more active, being less inactive, eating more fruit and veg and eating less junk food. Remember small changes that become your normal habit will have big effects on how happy and healthy you are for the rest of your life.

Appendix K

Instructor Manual – Session 1 (Parents)

Week 2, Session 3, 1st hour. Parents only.
Understanding adolescence and supportive parent behaviours. Lead by psychologist

Activity	Description	Time	Materials required
Understanding adolescence	Discuss/brainstorm what unique developmental conditions are for adolescents. Aim to convey through discussion large number of changes that occur in adolescents. Move towards independence whilst still needing secure attachment. Chance for parents to bond over common issues. Discuss ways for parents to encourage a positive relationship with their teenager.	15 mins	*Adolescent Development* Handout
Introduce self-determination theory (SDT) as related to adolescents	Facilitator to explain basic needs teenagers have. Key points are teenagers feeling they can choose for themselves, teenager feeling competent in their abilities, teenager having a sense of belonging	15 mins	*Important things for teenagers* handout
Introduce SDT as related to parent behaviors	Facilitator to explain behaviors parents can demonstrate to support teenagers' needs. Key points are parent behaviors that provide autonomy support, structure, and involvement.	15 mins	*Important things for parents* handout
Generate examples of parent behaviors and how these meet teenagers' needs	Facilitator to read examples provided by previous participants. Parents work in groups to think of ways a parent can demonstrate behaviors and how these meet the teenager's needs.	15 mins	*Blank paper and pens*
Homework	Keep practicing parent behaviors of providing structure, being involved and supporting teenager choices. Consider how this helps your teenager during the week.		

Session Goals: At the end of this session, participants will be able to:

- List key changes that occur during adolescence
- Describe the three important adolescent factors that parents need to support

- Describe the three important parent behaviours that support adolescent needs

Introduction:

- Adolescence is unique developmental period
- Ways to sustain a positive relationship with adolescent

Teenagers' experiences (~15 mins)

- Brainstorm developmental changes (e.g., physical, cognitive, social changes)
    - Physical, cognitive, social changes
    - Moving toward independence while still needing secure attachment to parent (explain degree of independence/dependence varies: 13 and 17 year olds have different requirements)
    - Focused more on peer relationships but still approach parents when experiencing problems or difficulties

Give each parent an 'Adolescent Development' handout

Discuss each topic on Page 1.

Maintaining a positive relationship:

Discuss each topic on Page 2.

Teenage needs (~15 mins)

Although adolescents experience a number of changes in their development, one thing that remains consistent is their desire to have three basic needs satisfied. These needs are (write these on whiteboard):

1. Feeling they can *choose for themselves*
2. Feeling *competent in their abilities*
3. Have a *sense of belonging*

Discuss what comprises each need:

1. Your teenager will **feel they can choose for themselves**

- Feeling like they have made their own choices to live by instead of someone else choosing for them or only doing behaviours to please others.
- *You may still guide them, but their behaviours are driven by their own motivations which helps them learn to accept and manage positive and negative outcomes associated with their behaviour choices to be more physically active and make healthy food choices. If teenagers feel like they are choosing their own behaviour changes, they are much more motivated and likely to follow through with change. For example a teenager might choose to*

play sport because they enjoy it, rather than because someone has told them to, or they are doing it to hear compliments from others.

2. Your teenager needs to **feel competent in their abilities**
    - Feeling like they can actually do the things they want to do, or the tasks that you ask them to do.
    - *It's not helpful if teenagers are encouraged to run around the oval if they are worried they might get so hot, sweaty and puffed that they won't be able to complete this. When teenagers complete a new challenge, they feel more confident about making the next challenge a bit more challenging and know they can use the skills they have developed to meet this challenge*.

3. Your teenager needs to **have a sense of belonging**
    - Feeling like they have support from people around them.
    - *Feel parents are interested in the processes and experiences they go through in attempting to change their physical activity and food habits*.

Give each parent a 'Three most important things for teenagers' handout

Examples of each need are listed on your sheet. Work in pairs to come up with one example for each need, then share responses with everyone.

Parent behaviors (~15 mins)
To help support teenagers' healthy lifestyle behaviors you can use three behaviors. These behaviors support teenagers' needs, and when these needs are supported, your teenager is more likely to engage in physical activity and healthy eating behaviors.

These behaviours are (write these on whiteboard):

4. Providing *structure*
5. Being *involved*
6. *Supporting teenager's choices*

Discuss what comprises each behavior:

1. **Provide structure**

    Providing consistent guidelines for behaviours, assistance to set realistic goals, and positive feedback regarding any progress. This relates to teenagers' need to feel competent.

    Three important behaviours within this:
    - Model positive behaviour to your teenager by setting and following through with your goals.
    - Give direct feedback to teenager's questions.
    - Provide tasks that are challenging but "do-able".

2. **Be involved**

   This relates to teenagers' need of feeling like they belong and are important. This will include emotional support like talking about how they are feeling, showing interest in their day-to-day lives as well as the time and resources that you will provide for them to support their healthy lifestyles.

   Three important behaviours within this:

   - Encourage your teenager by understanding their motivations for doing physical activity and making healthy food choices
   - Talk *with* your teenager instead of *at* them
   - Show interest and affection to your teenager by spending time with them and showing an interest in their daily lives.

3. **Support teenagers' choices**

   This relates to teenagers' need of feeling like they have some control over the choices that they make to eat healthy and do physical activity. This isn't necessarily giving teenagers free reign to make their own choices, but rather, you are supporting them to set their own goals, based on their own motivations and helping them to follow through with this. If parents are too controlling, and choose for their teenager or make them feel that a behaviour is performed only to please parents and not because the teenager values the behaviour, then the teenager is more likely to resist change and be unmotivated to perform the behaviour.

   Four important behaviours within this:

   - Offer several options for behaviour change using neutral language like "may" and "could" (instead of "should" or "must").
   - Offer praise for attempts at behaviour change
   - Respond positively to your teenager's issues (e.g., listening not telling)
   - Provide meaningful reasons when you are asking your teenager to do something

Give each parent a 'Three most important things for parents" handout

Examples of each need are listed on your sheet. Work in pairs to come up with one example for each need, then share responses with everyone.

Reviewing adolescent needs and parent behaviors (~15 mins)

Help get an understanding of how behaviours apply to teenager. Provide two examples from participants (below) and ask parents what behaviours they can use and how this meets the teenagers need.

Example 1: (insert from data completed at assessment)
Example response:

Example 2: (insert from data completed at assessment)
Example response:

Provide three more examples from participants and ask parents to work in pairs to come up with answers, and discuss responses as a group (provide paper and pens to record responses, if needed).

Example 1: (insert from data completed at assessment)
Example response:

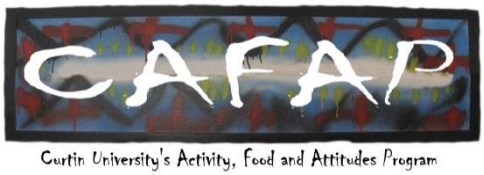
Example 2: (insert from data completed at assessment)
Example response:

Example 3: (insert from data completed at assessment)
Example response:

Session conclusion
Main things to take from today's session are:

- Teenagers have three basic needs.
- Using parenting parenting behavoiurs that support teenagers' choices, provide structure, and show involvement will help support these needs, which helps adolescents participate in physical activity and healthy eating behaviours.

The THREE most important things for TEENAGERS:



1. **<u>Feel competent in their abilities:</u>** Teenagers feel like they can actually do the things they want to do, or the tasks that you ask them to do.
   Eg/ Teenagers feel they have the ability to walk around the block for 15 minutes every day.

   Real life examples:

   _____
   _____
   _____
   _____

2. **<u>Have a sense of belonging:</u>** Teenagers feel like they have support from you and other people around them.
   Eg/ Teenagers feel that others are interested in their *experiences* and *activities* (maybe understanding how hard the activity might be or why they are doing that activity) in making behaviour changes.

   Real life examples:

   _____
   _____
   _____
   _____

3. **<u>Feel they can choose for themselves:</u>** Teenagers feel they made their own choices to live by instead of you or someone else choosing for them or only doing behaviours to please others.
   Eg/ Teenagers choose to play soccer because they enjoy soccer, and not because their parent made them to do soccer.

   Real life examples:

   _____
   _____
   _____
   _____

Examples of Needs Being Met

1. **<u>Feel competent in their abilities:</u>**
    - Teenagers practice solving math problems for homework to improve their skills which makes them feel that they will perform well on a test.
    - Teenagers feel they have the ability to walk around the block for 15 minutes every day after they do this with you for a few days. Succeeding in this helps them to go on to their next goal or keep up with the current one.
    - Teenagers practice structuring their day to allow time for a 2km walk after dinner which makes them feel that they will be able to successfully structure additional days during the week for 2km walks.

2. **<u>Have a sense of belonging:</u>**
    - Teenagers can work with others to solve a problem.
    - Teenagers feel that others regularly ask about their experiences in making behaviour changes.
    - Teenagers feel that others are interested in their experiences and attempts at behaviour change (maybe understanding how hard this attempt might be or why they are making the attempt).

3. **<u>Feel they can choose for themselves:</u>**
    - Teenagers value eating healthy and choose to eat fruit on most days instead of only when parents are watching.
    - Teenagers choose to do school assignments because they want to do well on their test, and not because they are avoiding consequences enforced by parents.

Week 3, Session 5, 1st hour. Parents only.
Parent Goal Setting. Lead by psychologist.

Activity	Description	Time	Materials required
Introduction	Facilitator to explain the purpose of the session. Parents will learn about how their teen has set goals, then practice setting parent goals to support the goals teenagers set to improve their health and physical fitness. Emphasis on parents' goals being about supporting teens' goals.	5 mins	*Example CAFAP matrix* *Example teenage weekly goal sheet*
Introduce goal setting concepts	Parents learn concepts behind teenagers' behaviour change goals.	15 mins	*Setting goals for my future sheet (parents)*
Provide example of setting parent support goals	Parents are taken through an example of setting support goals for a teenager's healthy eating goal.	15 mins	*Example teenage weekly goal sheet* *Example parent weekly goal sheet*
Parents practice setting support goals	Parents work in pairs and use other 2 teenage weekly goals to come up with some ideas for parent support goals. Responses are shared with the group. Examples provided if necessary	20 mins	*Example teenage weekly goal sheet* *Example parent weekly goal sheet* *Goal behaviour examples parents*
Demonstrating need supportive behaviours in goal setting	Briefly review tips for ways to incorporate need supportive behaviours in goal setting discussions with adolescents	5 mins	*Discussion tips for setting support goals with your teenager*

Session Goals: At the end of this session, participants will be able to:

- Set weekly goals related to supporting their teenager to improve their dietary intake and activity levels.

Introduction (~5 mins): Today is about:

- Learning how to set goals to support the goals your teenager will set to improve their health and physical fitness
- Review examples of goals a parent has set to support an adolescent's goals, then practice setting parent support goals.

What is the parent role?

- The goals you set relate to the things you will do to support the goals your adolescent has set for their physical activity, healthy eating, and sedentary behaviour changes.
- Next week, teenagers will set goals they would like to achieve by the end of the 8 week program

Show the parents an example of the CAFAP matrix the teens will use.

Explain how it works (guidelines on the far right, average Australian teen highlighted in grey, feedback from questionnaire and food diary will be circled for teens)

- Each week they will set weekly goals to help them work towards reaching their long-term goals

Give parents an example of a teenage weekly goal sheet

Details will be given later in the session but this is an overview of what the teenagers will do

- You will be asked to set weekly goals based on the overall and weekly goals your teenagers have set. These will be about supporting your teenager, and the things that you can do to help them achieve their lifestyle goals. We'll show you how to do this now.

GOAL SETTING CONCEPTS (~15 mins)

Weekly goal setting background:

- Provides a structure for reaching your long-term goals
- Helps provide a plan for how to achieve the behaviours you want to change
- Writing a concrete plan will help you regularly check your progress, which helps you see if you've achieved your goals and helps when you set new goals to achieve
- Setting smaller goals will help you have more manageable goals. This helps you to easily review your progress and you can use this feedback to set new goals. Smaller goals make it easier to achieve your goals, which helps build confidence, ultimately help you achieve behaviours to support the long-term goals set by teenagers.
- Each week teenagers will set their goals and then discuss these goals with you. You then set goals to support your teen's goals.

Explain that the following will be used by the teenagers to set their weekly goals. Use the example to show them where this has happened:

- **Challenging**: helps teenagers ensure their goal isn't "too easy" or "too difficult/impossible", which helps them stay motivated to achieve their goals and to continue working toward higher goals. Each week, we'll get teenagers to check how challenging their goals are by rating it on a scale of 0 to 10 with 10 being impossible and 0 being too easy.
- **Specific**: Helps teenagers and parents know what behaviours to work toward, which helps you see the progress you've made vs. vague goals (e.g., I want to be healthy).
    - Each weekly goal will include specific behaviours to work towards each day.
- **Reasons**:
    - What do you want to happen by reaching your goal?

- For teenagers, we encourage reasons related to improving health and physical fitness and limiting reasons related to their appearance.
- If you think about and visualize your reasons for setting a goal, you are more likely to be motivated and achieve your goal, particularly when your reasons relate to teenagers' health and physical fitness that they can personally measure, instead of things that others judge them on such as your appearance.
- When teenagers feel less motivated, try to get them to think about reasons they wanted to achieve the goal

- Why is this important that you achieve this goal?
  - For teenagers, we encourage reasons related to their enjoyment and values and limit reasons related to things they feel forced to do by significant others or a doctor.
  - Thinking about and visualizing reasons for goal setting that related to outcomes you value, will help you reach your goals.
  - When teenagers feel less motivated, try to get them to think about reasons for reaching their goals that relate to things they enjoy and value.

Give each participant a "Setting goals for my future parents" handout.

Goals will be set around physical activity, sedentary behaviour and healthy eating. You will get a goal setting template each week.

EXAMPLE SETTING PARENT SUPPORT GOALS (~15 mins)

Give each participant an "Example parent weekly goals" handout.

Use the healthy eating example to show parents how teenagers will set their goals (on the teenage example sheet), and then how parents set their own goals related to supporting that teenager goals (on the parent example sheet).
This EXAMPLE is not necessarily a relevant goal for parents in this group- it's more about HOW to do it.
Be sure to cover each step for how the parent set their goals (e.g., weekly goal, reasons, daily details). Note: Parents record their weekly goal as supporting adolescents' goal. This is done by writing the adolescent's goal next to the words "My goal this week is to support my teen's goal to" (point to how these are recorded from the teen example moving to the parent example).
Remember- these are not what the parents will do for their own healthy lifestyles, but specifically to support the healthy lifestyle goals their teens have set.

PRACTICE SETTING SUPPORT GOALS (~20 mins)
Parent to work in pairs to practice setting goals to support example teenage goals for physical activity and sedentary behaviour. Fill in the blanks on the parent sheet, using the teenage example goal sheet as your starting point. Parents may use "goal behaviour examples" handout if they get stuck for ideas – but try to modify and not directly copy these ideas.

Give each parent a "Goal behaviour examples parents" handout.

When pairs have had some discussion, go through their suggestions as a group.

Explain procedure for next week

1. Teenagers will set their overall goals
2. Teenagers will start to set their weekly goals
3. Parents will join teens and share their overall goals and weekly goals
4. Parent will talk to teen about their goals, and discuss ways that the parent might support them to achieve these goals
5. Parents will fill in their own goal setting sheet with these details, as well as the reasons they want to support their teen.

SUPPORTIVE BEHAVIOURS IN GOAL SETTING (~5 mins)
Remind parents to use the three behaviours to support adolescents' needs during goal setting discussion.

Give each participant a "Discussion tips for setting support goals with your teenager" handout.

Briefly read through tips.

Session Conclusion
So, the main things to take from today's session are

- Goal setting can be useful in helping to achieve positive things in your teenager's life
- Try to think about goals for improving your teenager's health and physical fitness which are based on your own reasons for wanting to achieve them (not others' reasons)
- Parent goals to be set arouns supporting the teenage goals
- Spend some time thinking about what you and your teenager's current habits are and some possible goals for the future. Try to discuss these with your teenager. This might help you start thinking of the goals you can set to support your teenager's goals to improve their health and physical fitness.
- Next session: Dicuss with your teenager the goals they've set and the support goals you can to help them reach their goals.

Sessions 6 and 15 – Joint session with adolescents – see Appendix I

Discussion tips for
setting support goals with your teenager

For each goal setting area (physical activity, sedentary behaviour, and healthy eating) try to use the following steps:

1. Review your teenager's weekly goals for improving their health and physical fitness and reasons for their goals.

2. Set your weekly goals to support your teenager's goals, and list your reasons for these goals.

3. Review your teenager's daily goals and discuss the daily goals for you to set to help support your teenager's goals.

4. Ensure goals are challenging, but do-able for both you and your teenager.

Remember to try and show the following behaviours during your discussions:

- **Provide structure:** Model realistic and challenging but do-able goals. Provide consistent guidelines when discussing the goals you set and any goals your teenager might have to modify. Provide feedback on your teenager's progress during the week.

- **Be involved:** Try to show an interest in the goals your teenager has set by asking and listening to their goals. Talk with your teenager about what motived them to set the goals. Then try to set goals which show that you have an interest in dedicating your time and energy to supporting things they value.

- **Support your teenager's choices:** Offer a range of choices for how you might be able to support your teenager. If you aren't able to perform a specific behaviour to support your teenager's goal, provide meaningful reasons why, and try to offer alternative choices. Respond positively to your teenager's concerns about their ability to meet their goals.

Appendix L

SMS Messages During 12-Month Follow-Up

Message Number	Message Text
1	Hope your goals are going well this week as you start back at school. Debbie will be calling sometime in the next few days to see how things are going.
2	After dinner can be a good time to eat some fruit. If you had less than 2 bits of fruit today, you might like some tinned apricots & yoghurt for dessert?
3	How about chatting with your parent(s) this weekend about what your goals are for this week.
4	What is your activity goal for tomorrow? How about arranging to be active with someone after school tomorrow?
5	Have you sat for more than 30 minutes at a time watching TV or playing on a computer today? See if you can have an active break every 30 minutes this evening.
6	How many steps have u done already today? How about trying to do 5,000 this afternoon?
7	What was your sedentary behaviour goal for today? Did you achieve your goal?
8	Some teenagers have told us that cut up fruit salad for recess helps them reach their healthy eating goals. What about taking some tomorrow?
9	How many vegies have u had today? If you're a bit behind with your 5 serves, why not choose to have some tomato and cucumber in your sandwich at lunch?
10	What are the reasons you want to be more active? You might like to think about these when the going gets tough!
11	A CAFAP teen has found using an egg-timer is a good way of knowing it's time for an active break after playing on the computer for 30mins. You could choose to try it too.
12	Have a look at your goals for physical activity, sedentary behaviour and healthy eating. Plan something fun to do this weekend to help meet your goals.
13	Remember the key messages of CAFAP are: eat more fruit and veg, eat less junk food, be less inactive and be more active.
14	What is your activity goal for tomorrow? How about setting your step counter to see how many steps you do tomorrow?
15	The CAFAP fruit muffins we made during the program are a great afternoon tea snack. You could make some today to help you achieve your goals for healthy eating!
16	Is there a friend or family member who could do some activity with you tomorrow to help you meet your goal?
17	Remember the benefits of breaking up sedentary time. How about making a game with your family to do a circuit exercise in each ad break on TV.
18	How much MVPA (huffing and puffing activity) have u done today? How about calling a friend to meet this arvo for an active game outside?

19	Think about how many bits of fruit u had today. If u had less than 2, you could try to add in 1 more piece tomorrow. How about some fruit on your cereal in the morning?
20	Other CAFAP teens tell us it's easier to be active when you are doing it with family or friends. Perhaps you could arrange to do this tomorrow to help meet your healthy activity goals?
21	To help meet your sedentary behaviour goals, why not plan when your favourite TV shows are on this week and try to limit your TV to just these shows?
22	Do you remember that the benefits of being more active include having a healthier heart and body chemistry, feeling less tired, sleeping better, being happier and thinking better?
23	Think about how many vegies u had today. If u had less than your goal, try to add in 1 more piece tomorrow. How about some vegie sticks with one of the yummy dips u made at CAFAP?
24	You seemed to enjoy kicking a ball when at CAFAP sessions. You might like to plan some more this week to help you meet your healthy activity goals.
25	Remember the key messages of CAFAP are: eat more fruit and veg, eat less junk food, be less inactive and be more active!
26	Is there a friend or family member who could do some activity with you tomorrow?
27	Several of the teens wanted to keep in touch with each other, so we have set up a private CAFAP Facebook group. If you add Debbie Cafap as a friend she will add you to the private CAFAP group.
28	What is your sedentary behaviour goal for today? Did you achieve your goal?
29	How many steps have you done today? How about trying to do a few extra thousand steps this afternoon?
30	We have put a great recipe for healthy snacks on the CAFAP private Facebook group. Perhaps you could make some?
31	Bananas are a good price at the moment, why not ask your parents to buy some in this week's shopping?
32	Have you sat for more than 30 mins watching TV/playing on a computer today? See if you can have an active break every 30 mins this evening.
33	Do you have a good idea for being active? How about sharing it with other CAFAP teens on the private CAFAP Facebook page?
34	What is your activity goal for tomorrow? How about setting up the step counter to see how many steps you do tomorrow?
35	How many serves of veg have you had today? How about some extra salad with dinner tonight?
36	What are your sedentary behaviour goals this week? Are they challenging enough for you? (CAFAP messages will only be coming each week from now on.)
First weekly 37 (on start day)	How about sharing a healthy snack idea with other CAFAP teens on the private CAFAP Facebook page?

38	Have a look at your activity and eating goals. What can your parent do this week to help you? Try to chat with them about it today.
39	Remember the benefits of breaking up sedentary time. How about making a game with your family to do a circuit exercise in each ad break on TV?
40	How much MVPA (huffing and puffing activity) have u done today? How about calling a friend to meet this arvo/later this week for an active game outside?
41	Do you have a good idea for being less inactive? How about sharing it with other CAFAP teens on the private CAFAP Facebook page?
42	Do you remember the benefits of being more active, being less inactive, eating less junk food and eating more fruit and veg? How about seeing if you remember more of them than your parent!
43	Have a think about your physical activity, sedentary behaviour and healthy eating goals. Plan something fun to do this weekend to help meet your goals.
44	Remembering the CAFAP classes, what was the activity you enjoyed most? How about adding some of this activity to your goals for this week?
45	Can you design a text message we could use to help other CAFAP teens to keep up with their goals when things get tough? If you think of a good one, why not send it to us?
46	What goals do you choose to aim for this week?
47	How about chatting with your parents today about your CAFAP goals for this week.
48	Which CAFAP healthy recipe have you enjoyed the most? How about making it this weekend?
49	What would be your best tip to other teenagers wanting to be more active, be less inactive, eat less junk food and eat more fruit and veg. Perhaps post it on the private CAFAP Facebook page?
50	This is the last weekly, CAFAP message – from now on they will be monthly. Keep up the good work with your goals!
First monthly 51	Do you need to update your goals this month? Let us know if you would like some help.
52	How about taking a photo of you meeting one of your activity or eating goals – and post it on the private CAFAP Facebook page?
53	Being active and eating well will help you feel healthier and happier. What would you like to challenge yourself with this month?
54	What has been the best thing for you about being in CAFAP? How about sharing it with the other CAFAP teens on the private CAFAP Facebook page?
55	Have a look at your goals for being more active and less inactive and eating healthy. How about sharing your goals with the other CAFAP teens on the private CAFAP Facebook page?
56	This is the last CAFAP SMS. You have done really well. Remember - eat more fruit and veg, eat less junk food, be less inactive and be more active – and you will feel happier and healthier!

Appendix M

Instructor Training – Program Rationale and Overview

Welcome to CAFAP Facilitators

Background

- CAFAP team members introduction
- 2009-2010 CAFAP run from Curtin after shift from PMH 'Fitmatters'
- Healthway funded 2011 interviews/focus groups with past participants, potential participants and key local and state government, health professional, research stakeholders to refine program for delivery by community health professionals in local communities
- Healthway funding 2012-13 development, delivery, 12 follow-up evaluation
    - Involves extra data collection from participants, health professionals etc.
    - At end of 2013 aim to have 'off the shelf' program for communities anywhere in the world to use

Philosophy

- ¼ Australian young people overweight/obese
    - Current adolescents at risk of being first modern generation to have shorter lives than their parents
    - First ran a community program for overweight kids ~30 years ago
    - Evidence-based intervention options: surgery or lifestyle
- Multi-disciplinary, family-centred, community-based
- Not a focus on weight loss
    - Can be unhealthy physically and mentally
    - Healthy habits have benefits regardless of weight loss
- After small but long lasting changes in habits
    - Small maintained change can have major long term health trajectory benefit
- Adolescent – both 'child' and 'adult'
    - Basic needs of choice, competence and belonging
    - Clear parent role in providing structure, being involved and supporting teenager choices
- Few, simple, repeated messages
    - Be more active, be less inactive, eat more fruit and veg, eat less junk
- Two behavior change concepts
    - Goal setting and monitoring
    - Motivation and autonomy support

Program

- Draft background – evidence base summary for each session
- Draft manual – script for each session
- Draft handouts – for teenager and parent sessions
- Training – 2 sessions on behavior change techniques
- Support – from CAFAP team

Appendix N

Instructor Training – Need-Supportive Behaviours

During this session you will learn a series of behaviours for you to use when delivering all of the program material. These behaviours will help adolescents and parents to use their own motivation to make healthy lifestyle changes to improve adolescents' health and physical fitness. These are the same behaviours we ask you to teach parents to use to continue supporting their teenagers' behaviours to improve their health and fitness in the home environment.

1) **Provide structure.**

   This is about providing consistent guidelines for behaviours, assistance to set realistic goals, and positive feedback regarding any progress.

   There are three important behaviours within this:

   - Demonstrate leadership by modelling positive behaviour to participants by demonstrating goal setting and behaviour change techniques. Next session we will explain the goal setting strategies for you to teach participants during week three.
   - Give direct feedback to participants' questions. Think about your response and answer questions directly.
   - Provide tasks that are challenging but "do-able" which maximise participants' abilities while taking account of others progressing at a slower rate (e.g., run for five minutes at their own page instead of running 5km).

Can you think of some examples where you might "provide structure" during the program? Prompt instructors to come up with these as a group.

EXAMPLES

- *Be prepared for each session in order to provide a clear understanding of the tasks involved.*
- *If participants are complaining about not being able to meet their goal of being active 5 times a week, take the time to discuss why this might be too hard. Help them come up with a plan that might be more realistic when setting their goals.*
- *If a participant doesn't understand a task, explain the specific area they are struggling to comprehend, using language they can understand.*

2) **Be involved**

This is about participants feeling like they belong and are important. This will include emotional support like talking about how they are feeling, showing interest in their day-to-day lives as well as the time and resources that you will provide for them to support their healthy lifestyle behaviour changes.

Three important behaviours within this:

- Encourage participants by understanding their motivations for behaviours
    - See if you can work with teenagers to understand the link between what motivates them to be physically active and eat healthy foods and the goals that they set and similarly try to identify the link between what motivates parents to support these behaviours and the support goals they set.
- Talk *with* participants instead of *at* them
    - Try to speak with participants, at their level by redistributing class dynamics by standing in the middle of participants and not lecturing at the front when explaining behaviours related to physical activity and eat healthy.
- Show an interest in participants' daily lives and behaviour change progress
    - Get to know participants' names. Spend time asking participants about their day and behaviour changes. Show participants that you enjoy spending time with them during the program.

Can you think of some examples where you might "be involved" in real life? Prompt instructors to come up with these as a group.

EXAMPLES

- *Use instances when participants show up early to the program to chat briefly about their day.*
- *Explore with participants goals they are interested in setting which link in with their values.*
- *Make time every so often to have a meaningful conversation with participants during the program, such as walk and talk sessions for parents or exercise sessions with teenagers.*
- *Make an effort to speak to participants at their level ie/ not yell out across the room at participants or always lecturing at the front of the classroom.*

3) **Support participants' choices**

This relates to participants feeling like they have some control over the choices they make to improve teenagers' health and physical activity. We know that if individuals feel like they are choosing their own behaviour changes, they are much more motivated and likely to follow through with change. This isn't necessarily giving participants free reign to make their own choices, but rather, you are supporting them to set their own goals, based on their own motivations and helping them to follow through with this. We know that if you as instructors are too controlling, and choose for participants, or if parents are too controlling, and choose for their teenager or make them feel that a behaviour is performed only to please parents

and not because the teenager values the behaviour, then the teenager is more likely to resist change and be unmotivated to perform the behaviour.

The four behaviours within this:

- Offer several options for behaviour change using neutral language like “may” and “could” (instead of “should” or “must”).
- Offer praise for attempts at behaviour change
- Respond positively to participants’ issues
    - Take time to listen when participants want to talk to you or complain about something. Try to understand where they are coming from and make your feedback positive.
- Provide meaningful reasons when you ask participants to do something
    - Helps participants understand what benefits they will gain from performing a behaviour and helps motivate them to perform the behaviour because they understand the positive health benefits.

Can you think of some examples where you might “support participants’ choices” in real life? Prompt instructors to come up with these as a group.

EXAMPLES

- *Offer praise when participants report that they went for a short walk instead of sitting down in front of the TV.*
- *Discuss participants’ goals with them and try to understand their motivations for setting these goals.*
- *Give teenagers some options for being active and eating healthy that they will enjoy.*
- *If a participant says something like “I didn’t have time to exercise today” instead of responding with “You must exercise everyday, you can’t wait until tomorrow”. Instead, try to understand why they ran out of time, remind them about the positive aspects of being active (i.e., improve health and physical fitness) and ask something like “Is there another time during the week where you might be able to fit this in?”*

Handout sheet: The THREE most important things for INSTRUCTORS to do.

So these three things are extremely important behaviours for you to try and work on. The definitions for each of these behaviours are provided on the handout. The majority of you might be doing some of these most of the time and we recognize that. What we would like you to do is try to make a concerted effort to use these behaviours at all times when instructing CAFAP sessions.

Role play

Need one volunteer to play role of adolescent participant and others note when behaviours (structure, supporting choices, and being involved) are used – discuss these as a group after role play.

Role play:

Read this scenario to everyone:
Teenage participant is a 15 year old girl named Sarah and is trying to set goals for physical activity during a CAFAP session.

Read the instructor parts of the role play and the volunteer reads the teenager parts of the role play.

Scenario: *explain* – Sarah is sitting down at a CAFAP session thinking of goals to set for physical activity.

Instructor starts by walking up to participant and sitting down in a nearby chair, on the same level as the participant (involvement).

Instructor: Hi Sarah (involvement), how are you going with setting your physical activity goals? Do you need any help? (involvement)

Teenager: I want to be physically active, but I have no idea where to start. What should I do?

Instructor: I can see how you find it overwhelming to come up with a starting point (autonomy). You seemed to really enjoy the soccer and basketball games we played last week, maybe setting a goal related to soccer or basketball would be a good place to start, what do you think? (autonomy, structure)

Teenager: You're right, I liked both soccer and basketball games, but I think soccer was slightly more fun. What goal should I set for soccer?

Instructor: That's a great question. Now that you've chosen which area to focus on (autonomy), let's work together to think about a specific goal (involvement, structure). When we played soccer last week you did a fantastic job on maintaining a moderate-to-vigorous intensity for 15 minutes. Using 15 minutes as your current level, maybe you could try playing soccer for 20 minutes one day this week with some of your friends. (autonomy, structure, involvement). By setting a challenging, but do-able goal, and then achieving that goal, it helps you to build up confidence about doing the task/activity and helps you to reach your goals in the future. (autonomy, structure)

Teenager: Thanks for the guidance. I think I'll set a goal for 15 minutes. Although I was able to play soccer at a moderate-to-vigorous intensity, I still found it challenging, so I think I'll try to maintain that next week, then maybe increase to a longer time in future weeks.

Instructor: Great thinking! You seem to have a very good understanding of what you find realistic, but challenging, and are taking the appropriate steps to slowly increase your exercise time over time at your own pace. (autonomy, structure, involvement)

Teenager: Yeah, I think I now have a better understanding of how to work toward my physical activity goals. Thanks for your help.

When the role play has finished, debrief this with the group.
Who noticed an example during that role play where I provided structure to the teenage participant? Discuss the key things you did.
Key points:

- *Providing a starting place for setting a physical activity goal (e.g., soccer and basketball suggestions)*
- *Demonstrating leadership by taking teenager through steps for setting a physical activity goal: choose activity she enjoys, thinking about baseline activity level (e.g., 15 minutes), trying to set challenging goals, suggesting incremental improvement*
- *Providing direct feedback to the teenager's questions about goal setting (e.g., what goals to set and how to set these goals)*

What was an example of me being involved? Discuss the key things you did.
Key points:

- *Sitting next to teenager on their level*
- *Used the teenager's name when approaching for discussion*
- *Asking the teenager about their goal setting progress and if they needed assistance*
- *Remembering the activities they enjoyed the most in previous weeks*
- *Exploring what the teenager enjoys and the level of activity they are comfortable doing*

How did I support the teenage participant's choices, without telling them what to do? Discuss the key things you did.
Key points:

- *Telling the teenager I understood their perspective on feeling overwhelmed when setting goals*
- *Suggesting the teenager choose from sports they enjoyed such as basketball and soccer*
- *Suggesting activities and goals using words such as "might", "try", and "could".*
- *Acknowledging that the teenager's chose their own goal behaviour (soccer)*
- *Providing meaningful rationale for setting challenging but do-able goals*
- *Praising the teenager for understanding their challenging but realistic physical activity levels*

Participants' needs
We've talked about behaviours that you could use as instructors to support participants to develop their own motivation to achieve their goals. Now we're going to look at this same topic, but from the participants' point of view.
The three most important things for both parent and teenager participants are:

7. **Feeling they can choose for themselves**
    - Instructor behaviour of **supporting participants' choices**.
    - Feeling like they have made their own choices to live by instead of someone else choosing for them or only doing behaviours to please others.

- *You may still guide them, but their behaviours are driven by their own motivations which helps them learn to accept and manage positive and negative outcomes associated with their behaviour choices to be more physically active and make healthy food choices. If participants feel like they are choosing their own behaviour changes, they are much more motivated and likely to follow through with change. For example a teenager might choose to play sport because they enjoy it, rather than because someone has told them to, or they are doing it to hear compliments from others.*

What are some examples of when participants might feel they can choose behaviours to engage in?

Prompt for instructors to share ideas with the group and you can discuss these and then write them down. If they are struggling, use the examples below.
Other examples:

- Teenagers value eating healthy and choose to eat fruit on most days instead of only when parents are watching.
- Parents choose to buy fruit instead of chips at the grocery store because they value providing healthier food to their adolescent, and not because they are avoiding negative judgement from others (e.g., instructor, other parents, doctor).

8. Participants need to **feel competent in their abilities**

- This relates back to your instructor behaviour of **providing structure**.
- Feeling like they can actually do the things they want to do, or the tasks that you ask them to do.
- *It's not helpful if teenagers are encouraged to run around the oval if they are worried they might get so hot, sweaty and puffed that they won't be able to complete this. Similarly, if parents try to cook meals 7 days a week but have never cooked, then they won't have confidence in their ability and won't complete the cooking task. When participants complete a new challenge, they feel more confident about making the next challenge a bit more challenging and know they can use the skills they have developed to meet this challenge*.

What are some other examples you might be able to think of where teenage and parent participants might behave in a certain way to help them feel competent in their abilities?

Prompt for instructors to share ideas with the group and you can discuss these and then write them down. If they are struggling, use the examples below.
Other examples:

- Teenagers practice solving math problems for homework to improve their skills which makes them feel that they will perform well on a test.

- Parents practice structuring their day to allow time for a family walk after dinner which makes them feel that they will be able to successfully structure additional days during the week for family walks.

9. Participants need to **have a sense of belonging**
    - This relates back to your instructor behaviour of **being involved**.
    - Feeling like they have support from people around them.
    - *Feel you are interested in the processes and experiences they go through in attempting to change their physical activity and food habits*.

What are some other examples you might be able to think of for parents and teenagers feeling like they have a sense of belonging?

Prompt for instructors to share ideas with the group and you can discuss these and then write them down. If they are struggling, use the examples below.

Other examples:

- Parents and teenagers can work with others to solve a problem.
- Parents and teenagers feel that instructors regularly ask about their experiences in making behaviour changes.
- Parents and teenagers feel that instructors are interested in their *experiences* and *activities* (maybe understanding how hard the activity might be or why they are doing that activity) in making behaviour changes.

Handout sheet THREE most important things for PARTICIPANTS.

Role play
Need one volunteer to play role of adolescent participant and others note when needs are met (feel they can choose for themselves, feel competence in their abilities, have a sense of belonging) – discuss these as a group after role play.

Role play:

Read this scenario to everyone:
Teenage participant is a 15 year old girl named Sarah and is trying to set goals for physical activity during a CAFAP session.

Read the instructor parts of the role play and the volunteer reads the teenager parts of the role play.

Scenario: *explain* – Sarah is sitting down at a CAFAP session thinking of goals to set for physical activity.

Instructor starts by walking up to participant and sitting down in a nearby chair, on the same level as the participant (involvement).

Instructor: Hi Sarah (involvement), how are you going with setting your physical activity goals? Do you need any help? (involvement)

Teenager: I want to be physically active, but I have no idea where to start. What should I do?

Instructor: I can see how you find it overwhelming to come up with a starting point (autonomy). You seemed to really enjoy the soccer and basketball games we played last week, maybe setting a goal related to soccer or basketball would be a good place to start, what do you think? (autonomy, structure)

Teenager: You're right, I liked both soccer and basketball games, but I think soccer was slightly more fun. What goal should I set for soccer?

Instructor: That's a great question. Now that you've chosen which area to focus on (autonomy), let's work together to think about a specific goal (involvement, structure). When we played soccer last week you did a fantastic job on maintaining a moderate-to-vigorous intensity for 15 minutes. Using 15 minutes as your current level, maybe you could try playing soccer for 20 minutes one day this week with some of your friends. (autonomy, structure, involvement). By setting a challenging, but do-able goal, and then achieving that goal, it helps you to build up confidence about doing the task/activity and helps you to reach your goals in the future. (autonomy, structure)

Teenager: Thanks for the guidance. I think I'll set a goal for 15 minutes. Although I was able to play soccer at a moderate-to-vigorous intensity, I still found it challenging, so I think I'll try to maintain that next week, then maybe increase to a longer time in future weeks.

Instructor: Great thinking! You seem to have a very good understanding of what you find realistic, but challenging, and are taking the appropriate steps to slowly increase your exercise time over time at your own pace. (autonomy, structure, involvement)

Teenager: Yeah, I think I now have a better understanding of how to work toward my physical activity goals. Thanks for your help.

When the role play has finished, debrief this with the group.
Who noticed an example during that role play where the teenager felt like they could choose for themselves? Discuss the key things you did.
Key points:

- *The teenager was told by the instructor that they should try to set goals for activities they enjoyed such as soccer and basketball*
- *The teenager felt the instructor understood their perspective on feeling overwhelmed when setting goals*

- *The teenager didn't feel forced to choose an activity due to the instructor's choice of words for suggesting activities and goals such as "might", "try", and "could".*
- *The teenager's belief that they got to choose their own goal was verbally confirmed by the instructor*
- *The teenager received meaningful rational for setting challenging but do-able goals*
- *The teenager received praise from the instructor for understanding their challenging but realistic physical activity levels*

What was an example of the teenager feeling competent in their abilities? Discuss the key things you did.
Key points:

- *The teenager felt they could set and achieve their goal after discussing a starting point for their physical activity goal*
- *After the instructor explained the steps for setting the physical activity goal, the teenager was able to talk through their current activity level and expressed confidence in the level of physical activity they set for their goal*
- *The teenager felt their questions about goal setting were directly answered and provided the knowledge base to feel competent in setting their own goals*

Who noticed an example during that role play where the teenager felt a sense of belonging? Discuss the key things you did.
Key points:

- *The teenager felt the instructor was talking to them on the same level by sitting next to them and not talking at them*
- *The teenager noticed the instructor using their name during the conversation and not grouping them with everyone else*
- *The teenager felt the instructor was interested in their goal setting progress and whether or not they needed assistance*
- *The teenager felt the instructor cared about their progress by remembering the activities they enjoyed the most in previous weeks*
- *The teenager felt the instructor spent time exploring what the teenager enjoyed and the level of activity they are comfortable doing instead of the instructor forcing their ideas on the teenager*

Practice demonstrating behaviours. Each person will have the opportunity to spend 5 minutes as the instructor and 5 minutes as the parent participant. During this time walk around the room and provide feedback on the instructor's behaviours.

The scenario is: You are walking next to a parent participant during a 'walk and talk' session. The parent expresses that she was able to make two homemade meals last week but is having difficulty cooking three homemade meals.

Walk around the room and provide feedback. Suggestions include:
Structure:

- Suggest that the task of three meals might be too challenging at the moment and ask if she would feel comfortable maintaining two meals a week for a while longer to maintain a goal that is challenging but do-able.
- Remind parent of setting do-able but challenging goals and to consider how three meals fits into this structure.
- Directly address the parent's question by reviewing barriers and addressing her motivations and possible solutions.

Involvement:

- Walk/sit in close proximity to the parent.
- Ask about her experiences in the past few weeks when cooking two meals a week.
- "Thinking of the reasons you have for cooking healthy meals might help. Maybe we can try discussing these reasons together."

Support choices:

- "I think it's great that you are working toward making three homemade meals a week."
- "I can understand how it might be difficult to make something you find easy and quick, but one that also differs from the previous two meals you made."
- "Maybe you could try cooking foods you feel comfortable making that don't require too much thought. This might help you feel more confident cooking by helping you easily plan what to buy at the store, how much time you need to cook the meal, and how to fit the cooking time in your busy schedule."

Bring everyone back as a single group. Ask if any instructors have questions regarding the behaviours.

SUCCESSFUL CHANGE

The **THREE** most important things for **INSTRUCTORS** to do:

1. **Provide structure:** Providing consistent guidelines for behaviours, assistance to set realistic goals, and positive feedback regarding any progress.
    - Demonstrate how to set goals and perform techniques for behaviour change to improve physical fitness and healthy eating
    - Give direct feedback to participant's questions
    - Provide tasks that are challenging but "do-able"

    Real life examples:

    _____
    _____
    _____
    _____

2. **Be involved:** Making participants feel like they belong and are important.
    - Encourage teenagers by understanding their motivations for doing physical activity and healthy eating behaviours and understanding parents' motivations for supporting these behaviours
    - Talk *with* participants instead of *at* them
    - Show interest in participants' well-being and progress in their physical activity and healthy eating behaviour changes

    Real life examples:

    _____
    _____
    _____
    _____

3. **Support participants' choices**
    - Offer several options for behaviour change using neutral language like "may" and "could" (instead of "should" or "must")
    - Offer praise for attempts at behaviour change
    - Respond positively to participants' issues related to physical activity and healthy eating behaviour changes
    - Provide meaningful reasons when asking participants to do something

    Real life examples:

    _____
    _____
    _____
    _____

Behaviour Examples

Provide structure:

- Ask participants to run for 5 minutes at their own pace, instead of asking all participants to run 5km.
- Be prepared for each session in order to provide a clear understanding of the tasks involved.
- If participants are complaining about not being able to meet their goal of being active 5 times a week, take the time to discuss why this might be too hard. Help them come up with a plan that might be more realistic when setting their goals.
- If a participant doesn't understand a task, explain the specific area they are struggling to comprehend, using language they can understand.

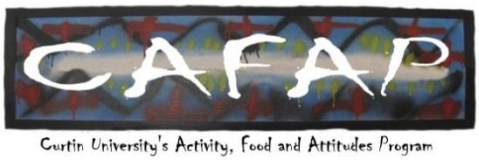
Be involved:

- Use instances when participants show up early to the program to chat briefly about their day.
- Explore with participants goals they are interested in setting which link in with their values.
- Make time every so often to have a meaningful conversation with participants during the program, such as walk and talk sessions for parents or exercise sessions with teenagers.
- Make an effort to speak to participants at their level ie/ not yell out across the room at participants or always lecturing at the front of the classroom.

Support choices:

- Offer praise when participants report that they went for a short walk instead of sitting down in front of the TV.
- Discuss participants' goals with them and try to understand their motivations for setting these goals.
- Give teenagers some options for being active and eating healthy that they will enjoy.
- If a participant says something like "I didn't have time to exercise today" instead of responding with "You must exercise everyday, you can't wait until tomorrow". Instead, try to understand why they ran out of time, remind them about the positive aspects of being active (i.e., improve health and physical fitness) and ask something like "Is there another time during the week where you might be able to fit this in?"

The **THREE** most important things for **PARTICIPANTS**:



1. **<u>Feel they can choose for themselves:</u>** Participants feel they made their own choices to live by instead of someone else choosing for them or only doing behaviours to please others.
   Eg/ 1) Teenagers choose to play soccer because they enjoy soccer, and not because their parent made them to do soccer. 2) Parents choose to walk with their teenager because they value improving their teenager's health.

   Real life examples:

   _____
   _____
   _____
   _____

2. **<u>Feel competent in their abilities:</u>** Participants feel like they can actually do the things they want to do, or the tasks that you ask them to do.
   Eg/ 1) Teenagers feel they have the ability to walk around the block for 15 minutes every day. 2) Parents feel they have the ability to help their teenager pack a healthy homemade lunch for school.

   Real life examples:

   _____
   _____
   _____
   _____

3. **<u>Have a sense of belonging:</u>** Participants feel like they have support from people around them.
   Eg/ Teenagers and parents feel that others are interested in their *experiences* and *activities* (maybe understanding how hard the activity might be or why they are doing that activity) in making behaviour changes.

   Real life examples:

   _____
   _____
   _____
   _____

Examples of Needs Being Met

Feel they can choose for themselves:

- Teenagers value eating healthy and choose to eat fruit on most days instead of only when parents are watching.
- Parents choose to buy fruit instead of chips at the grocery store because they value providing healthier food to their adolescent, and not because they are avoiding negative judgement from others (e.g., instructor, other parents, doctor).

Feel competent in their abilities:

- Teenagers practice solving math problems for homework to improve their skills which makes them feel that they will perform well on a test.
- Parents practice structuring their day to allow time for a family walk after dinner which makes them feel that they will be able to successfully structure additional days during the week for family walks.

Have a sense of belonging:

- Parents and teenagers can work with others to solve a problem.
- Parents and teenagers feel that instructors regularly ask about their experiences in making behaviour changes.
- Parents and teenagers feel that instructors are interested in their *experiences* and *activities* (maybe understanding how hard the activity might be or why they are doing that activity) in making behaviour changes.

Evidence Summary – Need Supportive Behaviours

Key concepts

- Demonstrating behaviours which support adolescents' choices, provide structure, and show involvement influences their motivations to engage in healthy behaviours.
- Motivations are influenced because these behaviours meet adolescents' basic needs related to feeling they can choose for themselves, have competence in their abilities, and have a sense of belonging.

Self-determination theory (SDT)[1, 2]

Adolescent's perceptions of the degree to which parents provide these behaviours will influence if their basic needs are met, which predicts their motivation to perform a physical activity and healthy eating behaviours. If these behaviours aren't provided, adolescents' needs will not be met and they will be amotivated or extrinsically motivated, that is, they are only motivated to do the behaviour when controlled by others (e.g., only perform when someone forces them to do the behaviour). If adolescents' perceive that these behaviours are provided, their needs will be met and they will be intrinsically motivated (motivated out of their own interest and enjoyment). When adolescents are intrinsically motivated, as opposed to amotivated or extrinsically motivated, they are more likely to continue to perform the behaviour because they have taken it on as their own. This theory has been demonstrated across Eastern and Western cultures [3-6], age groups [7-11], and genders [12, 13].

Correlational studies

Structure:

- Children [14] and adolescents' [15] perceptions of structure provided by classroom and physical education (PE) teachers, respectively, positively predicts their degree of self-determined motivation for class participation.

Involvement:

- When teachers express affection and devote resources such as time and energy, they tend to provide an optimal environment for students' development of relatedness and self-determined motivation [16, 17].
- Parental involvement is the most important parenting behaviour for the development of adolescents' self-regulation [18].
- Attachment research shows that more positive health outcomes are reported by adolescents whose parents provide a secure base for their adolescents to explore their personal identity [19, 20].

Autonomy support:

- Adolescents' perception of PE teacher supporting students' choices positively predicts their intrinsic motivation and intention to participate in physical activity [21-23].

- Perceptions of significant others (friends and family members) supporting adults' choices predicts intentions to participate in physical activity [24], participation in physical activity [23], and self-regulation of weight loss goals [25].

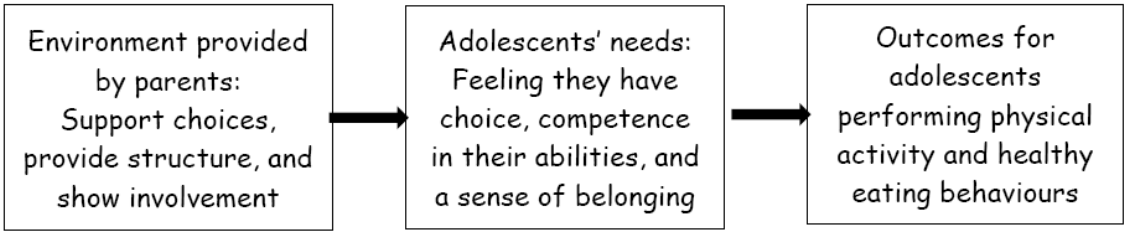
Intervention studies

- Training instructors: Based on intra-rater observations and self-report measures, studies have shown that classroom teachers [26], university tutors [27], and PE teachers [28] can be trained to demonstrate these behaviours.
- Participant outcomes:
    - Adolescents taught by PE teachers trained to support their choices reported stronger intentions to participate in exercise during leisure time and participated more frequently in leisure-time physical activity in comparison to students taught by PE teachers in the control condition [29].
    - Participants taught by instructors trained to support their choices, provide structure, and be involved reported significantly higher levels of their needs being met for feeling they can choose for themselves, have competence in their abilities, and have a sense of belonging; class enjoyment; and attendance levels relative to participants assigned to the control condition [30].

Summary

The parent training session covering concepts of self-determination theory will provide the skills and knowledge for parents to provide home environments for their adolescents which support their choices, provide structure, and show involvement in order to enhance adolescents' intrinsic motivation to have continued engagement in physical activity and healthy eating behaviours.

Figure 1. Self-determination model of health motivation (adapted from [31])



References

1. Deci, E.L. and R.M. Ryan, *The "what" and "why" of goal pursuits: human needs and the self-determination of behavior.* Psychological Inquiry: An International Journal for the Advancement of Psychological Theory, 2000. **11**(4): p. 227 - 268.
2. Deci, E.L. and R.M. Ryan, *Intrinsic motivation and self-determination in human behavior*. 1985, New York: Plenum Press.
3. Chirkov, V.I. and R.M. Ryan, *Parent and teacher autonomy-support in Russian and U.S. adolescents.* Journal of Cross-Cultural Psychology, 2001. **32**(5): p. 618-635.
4. Chirkov, V.I., R.M. Ryan, and C. Willness, *Cultural context and psychological needs in Canada and Brazil.* Journal of Cross-Cultural Psychology, 2005. **36**(4): p. 423-443.
5. Ryan, R.M., et al., *On the interpersonal regulation of emotions: Emotional reliance across gender, relationships, and cultures.* Personal Relationships, 2005. **12**(1): p. 145-163.
6. Vansteenkiste, M., et al., *Autonomy and relatedness among Chinese sojourners and applicants: Conflictual or independent predictors of well-being and adjustment? .* Motivation and Emotion 2006. **30**(4): p. 273-287.
7. Brunet, J. and C.M. Sabiston, *Exploring motivation for physical activity across the adult lifespan.* Psychology of Sport and Exercise, 2010. **12**(2): p. 99-105.
8. Deci, E.L., et al., *The relation of mothers' controlling vocalizations to children's intrinsic motivation.* Journal of Experimental Child Psychology, 1993. **55**(2): p. 151-162.
9. Grolnick, W.S., A. Frodi, and L. Bridges, *Maternal control style and the mastery motivation of one-year-olds.* Infant Mental Health Journal, 1984. **5**(2): p. 72-82.
10. Grolnick, W.S. and R.M. Ryan, *Parent styles associated with children's self-regulation and competence in school.* Journal of Educational Psychology 1989. **81**(2): p. 143-154.
11. Niemiec, C.P., et al., *The antecedents and consequences of autonomous self-regulation for college: A self-determination theory perspective on socialization.* Journal of Adolescence, 2006. **29**(5): p. 761-775.
12. Ntoumanis, N., *A self-determination approach to the understanding of motivation in physical education.* British Journal of Educational Psychology, 2001. **71**(2): p. 225-242.
13. Standage, M., J.L. Duda, and N. Ntoumanis, *A test of self-determination theory in school physical education.* British Journal of Educational Psychology, 2005. **75**(3): p. 411-433.
14. Skinner, E.A. and M.J. Belmont, *Motivation in the classroom: reciprocal effects of teacher behavior and student engagement across the school year.* Journal of Educational Psychology 1993. **85**(4): p. 571-581.
15. Taylor, I.M. and N. Ntoumanis, *Teacher motivational strategies and student self-determination in physical education.* Journal of educational psychology, 2007. **99**(4): p. 747-760.
16. Deci, E.L. and R.M. Ryan, *A motivational approach to self: integration in personality*, in *Nebraska symposium on motivation: Vol. 38. Perspectives on*

Appendix O
Instructor Training – Goal Setting

INTRODUCTION

- Learn how to teach teenagers and their parents how to use goal setting strategies to improve teenager's health and physical fitness.
- Goal setting will help provide a structure for participants to implement their intrinsically motivated behaviour changes.

GOAL SETTING FORMAT

- Session 5 and 6: Participants learn how to set goals and set their overall and first weeks' goals
- Goals reviewed and new goals set once a week
- Teens will set goals for physical activity, sedentary behaviour, and healthy eating.
- Parents will join them and have a discussion with teens to set their own goals to support their teens' goals.

We will go through how to help teenagers set goals, then how to explain goals to parents, and finally how to bring teenagers and parents together to set goals.

TEENAGE GOAL SETTING

Teenage overall goals

- Goals teenagers want to reach by the end of the program. These will be broken into smaller more manageable weekly goals.
- At the end of the program teenagers will set new overall goals to reach in three months' time at the follow-up assessment.

Steps for setting overall goals:

Distribute "Adolescent goal setting booklet" – see Appendix R (adolescent goal setting booklet)

Each adolescent will receive their own individualized booklet, like the one you've been given.

Turn to overall goal matrix and explain the following:

- Area in grey indicates national average
- Area on far right (sore of 10) are the recommended guidelines
- Prior to the session start you will be provided information collected in the baseline assessments and asked to record this information on their matrix by putting a square around their current activity levels
- During the session you will confirm these levels with participants

Adolescents will then indicate where they would like to be at the end of the program by putting a square around that behaviour. We ask that you explain the following:

- Based on your current levels we'll work on setting goals for you to achieve by the end of the program in 4 weeks' time.

- These goals will be broken down into smaller more manageable goals to achieve each week. So think about what goal you think you can work toward each week to reach in four weeks.
- Try to set realistic goals that are challenging, but not extremely difficult, or too easy. Setting challenging goals will help you stay motivated, ultimately helping you reach your goal behaviors.
- Moving a single score, for example from 1 (MVPA: 10mins 3 x wk) to 2 (MVPA: 20mins 3 x wk) will result in a significant improvement in your health.

Distribute "Example adolescent overall goal matrix" handout – see Appendix R (adolescent goal setting booklet)

Show baseline (squared) behaviours and overall (circle) goal behaviours.

Teenage weekly goal setting

Explain purpose of weekly goal setting:

- Provides a structure for reaching overall goals
- Helps provide a plan for how to achieve behaviors teens want to change
- Writing a concrete plan will help teens regularly check their progress, which helps them see if they've achieved their goals and helps when they set new goals to achieve
- Breaking overall program goals into smaller goals will help teens have more manageable goals. This helps them to easily review their progress and they can use this feedback to set new goals. Smaller goals make it easier to achieve their goals, which helps build confidence, ultimately helping them to reach their overall program goal.
- To help teens achieve goals, each week you'll work with them to set goals, and then get parents to work with teens to set goals for behaviors they can do to support the behavior change goals teens choose.

Explain goals teenagers should try to set each week. Explain that setting these types of goals makes it more likely that they will reach the goals they set to improve their health and physical fitness:

- **Challenging**: helps ensure goal isn't "too easy" or "too difficult/impossible", which helps teens stay motivated to achieve their goals and to continue working toward higher goals. Each week, get teens to check how challenging their goals are by rating it on a scale of 0 to 10 with 10 being impossible and 0 being too easy.
- **Specific**: Helps teens know what behaviors to work toward, which helps them see progress they've made vs. vague goals (e.g., I want to be healthy).
    - You'll work with teens to help them record specific behaviors to work toward each day (these will be explained later).
- **Reasons**:
    - What do you want to happen by reaching your goal?
        - Ask teens to try to think of reasons related to improving their health and physical fitness and limit reasons related to appearance. If they think about and visualize reasons for setting a goal, they are more

likely to be motivated and achieve their goal, particularly when their reasons relate to their health and physical fitness that they can personally measure, instead of things that others judge them on such as your appearance.

- Why is this important that you achieve this goal?
  - Ask teens to try to think of reasons related to their enjoyment and values and limit reasons related to things they feel forced to do by their parent or doctor. Thinking about and visualizing reasons for goal setting that relate to outcomes they value, will help them reach their goals.

The types of goals to set are outlined in each teen's goal booklet (show page).

Example goal setting
We'll now go over the example of how to set weekly goals, which is the same example you'll be asked to lead teens through. To give you an idea of what you will be asking participants to do, the example will be delivered as you would do in the program, and you will be asked to respond as teenagers will be asked in the program. Lead example – overall goals into weekly goal (sedentary behavior):

Read aloud: *If an adolescent currently has 3.5 hours of sedentary behavior each day, and they want to have a maximum of 3 hours by the end of the program, where should they set their goal for the first week? (write baseline levels and program goals on whiteboard).*
Ask instructors to come up with what they think a good goal is for the first week. Write first weeks' goal on whiteboard. Ask instructors to rate how challenging the goal is (0 to 10) and ensure it is around a 6-8.

Ask instructors to come up with reasons for setting this goal. Write these reasons on the whiteboard.

- What do you want to happen by achieving the goal _____
- Why is it important you achieve this goal _____

Goal behavior examples can be used to help come up with activities to help reach goals. Example of weekly goals (how it might look) is also included in the goal setting booklet.

Come up with ways to reach the example teenager's goal. Write on whiteboard how their goal behaviors fit in to each day of the week (e.g., Monday video games 4.00 to 6.00 and 7.00 to 8.00, Tuesday Simpsons and Glee, Wednesday computer games 6.00 to 8.00, etc.). Behaviors may be written as names of the TV shows they might watch and/or the specific times when they plan to be on the computer or play video games – choose whichever way works best. Remind instructors that by putting times on things it might make it easier for teens to remember the maximum amount of time to spend in each behavior.

Refer instructors to example of sedentary behavior in their goal setting booklet.

Setting sedentary behavior goal

Use overall goals and weekly goals in goal setting booklet.

Take instructors through how they will lead teens in setting their own sedentary behavior goals. Follow steps used in example above (listed below):

- Review current behavior levels and overall goals
- Break overall goal into first week goal and record this goal on their weekly goal sheet (point to area)
- List reasons (why and what), remind teenagers to think of reasons:
    - Related to improving their health and physical fitness and limit reasons related to appearance
    - Related to their enjoyment and values and limit reasons related to things they feel forced to do by their parent or doctor
- List daily behaviors, including times for sedentary behavior. May refer to example behavior sheet and come up with their own reasons, the choice is up to them.
- Record challenge rating for the goal (0 – 10). Check rating is between 6–8.

PARENT GOAL SETTING

The same information will be provided to parents regarding reasons and structure for overall and weekly goal setting. The processes of how teens set their goals and how parents will support these goals will then be explained to parents.

- The goals parents set relate to the things they will do to support the goals their teen has set for their physical activity, healthy eating, and sedentary behaviour changes.
- Parents will be asked to set weekly goals based on the overall and weekly goals their teenagers have set. These will be about supporting teens, and the things that parents can do to help them achieve their lifestyle goals.

Example setting parent support goal

Explain: Instructors will use the healthy eating example to show parents how teenagers will set their goals (on the teenage example sheet), and then how parents set their own goals related to supporting that teenager goals (on the parent example sheet – shown in booklet).

Handout “example teenage weekly goals”.

Be sure to cover each step for how parents set their goals (e.g., weekly goal, reasons, daily details). Note: Parents record their weekly goal as supporting adolescents’ goal. This is done by writing the adolescent’s goal next to the words “My goal this week is to support my teen’s goal to” (point to how these are recorded from the teen example moving to the parent example).

Remind instructors- these are not what the parents will do for their own healthy lifestyles, but specifically to support the healthy lifestyle goals their teens have set.

Practice setting parent support goals

Instructors work in pairs to practice setting goals as parents to support example teenage goals for physical activity and sedentary behaviour. Instructors fill in the blanks on the

parent sheet, using the teenage example goal sheet as their starting point. Instructors may use "goal behaviour examples" in their booklet if they get stuck for ideas – but try to modify and not directly copy these ideas.
When pairs have had some discussion, go through their suggestions as a group.

COMBINED GOAL SETTING SESSION

- Teens set weekly goals with instructor (no parents) for healthy eating and physical activity
- Teens join parents and share their overall and weekly goals.
- Parents will talk to teen about their goals, and discuss ways that the parent might support them to achieve these goals
- Parents will fill in their own goal setting sheet with these details, as well as the reasons they want to support their teen.

TEENAGERS SET WEEKLY GOALS FOR PHYSICAL ACTIVITY AND HEALTHY EATING.
Take teenagers through the same steps as they did for sedentary behaviour in the previous session (conducted earlier in instructor training session).

After goals are set you will need to get parents who will be with the physiotherapist. Please interrupt their session as they are waiting for you to collect them.

PARENTS SET GOALS:

- Teens share overall goals with parents and parents record these goals
- Teens share weekly goals with parents to help them set goals to support the goals you've chosen to improve your health and physical fitness
- Parents set weekly to support teens' goals in discussion with their teen

OVERALL GOALS
Parents and teens turn to overall goal matrix in their respective booklets. Lead teens through sharing their goals with parents:

- Explain this will help parents see where the teen is and where they'd like to be so they can set goals to support these goal behaviors
- Parents circle teens' current levels (square) and overall goals (circle)

WEEKLY GOALS
Parents and teens turn to first weekly goals sheet in their respective booklet. Teens share weekly goals with parents. Guide through sharing, one behavior at a time:

4. Physical activity
    - Weekly goal: Teen tells parent their weekly goal, parent writes their support weekly goal in their booklet by recording the teen's weekly goal next to the words "My goal this week is to support my teen's goal of".
    - Parents list reasons (what they want to happen and why it is important): Tell parents: *remember to think of reasons related to improving teenagers' health and your values/enjoyment, and limit reasons related to your teenagers'*

appearance and what others have told you to do that you don't necessarily value.

- Daily details: Teens share their daily details. Parents list behavior goals that map onto behaviors teenagers have listed (may not be one listed for each day if teenager doesn't need support, e.g., they have listed a school activity)
- Parents record challenge rating (0 to 10) next to each daily goal behavior.

5. Sedentary behavior
    - Steps as above

6. Healthy eating
    - Steps as above

REVIEWING GOALS

Evidence Summary – Goal Setting

Key concepts – goal setting

- Parents and adolescents will learn goal setting strategies to improve adolescents' health and physical fitness.
- Goal setting will provide a motivational framework for planning their behaviour changes.
- The types of goals parents and adolescents set will influence their goal achievement.

Goal setting

Goal types:

Goal setting has been shown to be a useful strategy for facilitating behaviour changes related to physical activity and healthy eating. However, the types of goals individuals set may influence the degree to which they engage in healthy lifestyle behaviour changes. The types of goals which enhance goal attainment and the supporting empirical evidence for each type is outlined below.

- **Specific (daily details):** Detailing the amount and frequency of the goal (i.e., walk 1km a week for five weeks).
    - Provides clear behaviour standards to evaluate performance and adjust strategies for goal attainment if necessary [1].
    - Meta-analyses have shown that individuals achieve higher performance levels when setting specific and difficult goals in comparison to "do your best" goals [1].

- **Difficult:** Setting optimally challenging goals.
    - Leads to greater effort and persistence than setting easy goals [1].
    - More motivating – requires a higher level of performance for one to be satisfied in comparison to attaining easy goals [1].
    - PE teacher's provision of optimally challenging tasks has been shown to enhance students' basic need for competence and self-determination to perform physical activity during leisure time [2].

- **Overall goals and subgoals (weekly):** Breaking overall long-term goals into smaller more manageable subgoals:
    - Subgoals provide clear indicators of progress which are likely to increase perceived self-efficacy by providing individuals with frequent feedback [3, 4] to self-evaluate accomplishments and change strategies for goal attainment if discrepancies exist between goals and performance [1].

- **Goal content (what you want to achieve):** Refers to the type of goal pursued: *intrinsic* (i.e. health and personal growth) or *extrinsic* (i.e., appearance and wealth) goals.
    - Focusing classroom intervention sessions for obese children on the goal of health (i.e., intrinsic goal) rather than the goal of attractiveness (i.e., extrinsic goal) predicted need satisfaction (autonomy, competence, relatedness) and

showed significantly greater initial weight loss and maintenance at two year follow up [5].
    - Participants' intrinsic goal framing resulted in higher learning performance for children regardless of their goal content endorsed prior to the intervention [6].
- **Goal motive (why the goal is important):** Explains whether goal strivings are performed for reasons related to inherent enjoyment/value or external pressure.
    - Pursuing goals for inherent enjoyment/value motives has been shown to predict increased effort toward goal striving which was positively related to goal attainment [7-11].

Summary

The initial goal setting session will cover concepts from goal setting theory and self-determination theory to provide the skills and knowledge for adolescents to set behaviour change goals and parents to set goals to support their adolescents' behaviour change goals. Setting goals based on these theories should reduce goal conflict and increase goal attainment. Goals will be reviewed weekly and new goals set using the concepts introduced in the first session.

References

1. Locke, E.A. and G.P. Latham, *A theory of goal setting and task performance*. 1990, Englewood Cliffs, New Jersey: Prentice Hall.
2. Standage, M., J.L. Duda, and N. Ntoumanis, *A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions.* Journal of Educational Psychology, 2003. **95**(1): p. 97-11010.1037/0022-0663.95.1.97.
3. Latham, G.P. and G.H. Seijts, *The effects of proximal and distal goals on performance on a moderately complex task.* Journal of Organizational Behavior, 1999. **20**(4): p. 421.
4. Stock, J. and D. Cervone, *Proximal goal-setting and self-regulatory processes.* Cognitive Therapy and Research, 1990. **14**(5): p. 483-498.
5. Vansteenkiste, M., et al., *Promoting maintained weight loss through healthy lifestyle changes among severly obese children: An experimental test of self-determination theory*, in *Unpublished manuscript*. 2007: University of Ghent, Belgium.
6. Vansteenkiste, M., et al., *Does extrinsic goal framing enhance extrinsic goal-oriented individuals' learning and performance? An experimental test of the match perspective versus self-determination theory.* Journal of Educational Psychology 2008. **100**(2): p. 387-397.
7. Ryan, R.M. and J.P. Connell, *Perceived locus of causality and internalization: Examining reasons for acting in two domains.* Journal of Personality and Social Psychology, 1989. **57**: p. 749-761.
8. Sheldon, K.M. and A.J. Elliot, *Goal striving, need satisfaction, and longitudinal well-being: The self-concordance model.* Journal of Personality and Social Psychology, 1999. **76**(3): p. 482-497.
9. Sheldon, K.M. and A.J. Elliot, *Not all personal goals are personal: Comparing autonomous and controlled reasons for goals as predictors of effort and attainment.* Personality and Social Psychology Bulletin, 1998. **24**: p. 546-557.
10. Sheldon, K.M. and L. Houser-Marko, *Self-concordance, goal attainment, and the pursuit of happiness: can there be an upward spiral?* Journal of Personality and Social Psychology, 2001. **80**(1): p. 152-165.
11. Vasalampi, K., K. Salmela-Aro, and J.E. Nurmi, *Adolescents' self-concordance, school engagement, and burnout predict their educational trajectories.* European Psychologist, 2009. **14**(4): p. xxx-xxx.

Appendix P

Goal Setting Sheet

	Physical Activity				Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	My goal this week is: _____ _____C:_ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____			Overall progress Weekly progress	My goal this week is: _____ _____C:_ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is: _____ _____C:_ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress
		C	Goal Steps	Actual Steps		C		C
Fri								
Sat								
Sun								
Mon								
Tue								
Wed								
Th								

Appendix Q

Phone Coaching Guide – Need-Supportive Behaviours

Phone Coaching issues

- Keep to CAFAP key messages – no 'fringe' advice
- Be non-directive – to give teen choice/autonomy
- Be involved – get to know them/what they do/their goals
- Provide structure – use goal matrix and weekly plan sheet
- Provide positive feedback for when goals have been met or even just attempted

Goals

- Talk through matrix and weekly goal plan – so we have a record of what they are aiming for to make our conversations tailored to them and their goals

Healthy Eating

- See if they can think of a fruit and a veg they would like this week and add these to family shopping list
- See if there are times of the day or week when they find it hard to resist junk food and see if they can come up with strategies to avoid this.
- Talk about any good ideas they have for healthy recipes – with great taste, low fat, lots of nutrients.

Physical activity

- Check if they have a daily plan to match their weekly goal
- See if there are regular organised activities they are interested in joining
- See if they are using the pedometer and encourage them with this as a goal and ask about their daily counts

Sedentary Behaviour

- Check if they have TV in their room – suggest they try taking it into a family room for a week.
- See if they have an egg timer they can use to limit screen time to 30mins at a time
- See if there are times of the day or week when they find it hard to resist lots of screen time and see if they can come up with strategies to avoid this.

Appendix R
Adolescent Goal Setting Booklet

ADOLESCENT

CAFAP

GOAL SETTING

BOOKLET

Setting Goals for My Future

Setting goals can help you to change your behaviour and achieve the things you want to do in your life. You may do this by writing down what you want to accomplish and how you will carry out your plan. Below are guidelines you might want to consider when setting goals.

Overall goals

Setting overall goals for longer periods of time (eg/ by the end of CAFAP or for 3 months' time) is useful to help you to achieve things that might take a bit longer to do.

Weekly goals

Setting weekly goals helps to break down your overall goals into smaller and more achievable chunks. These should be goals that, with a bit of effort, you can realistically achieve in a week.

Specific

When you set your goals, try to write them as clearly as you can to make it easier to know when you've reached your goal. On your goal setting sheet, there are three sections to record your different goals. There is one for physical activity, one for sedentary behaviour and one for healthy eating. You can write your weekly goal at the top of each column.

Reasons

After you've written your goal it can be a good idea to state your reasons for choosing this goal, which may help you to achieve it. The reasons you have for choosing a goal often influence your motivation to change your behaviour and ultimately reach your goal. The two reasons you might want to consider are:

What do you want to happen as a result of reaching your goal? Or what are you aiming to improve by achieving your goal? For example, are you striving to *gain better health and fitness* or *to look more attractive*? If you set goals focused on improving things that matter to you instead of things that matter to others, is more likely that you will achieve your goal.

Why is this important that you achieve this goal? Or why have you chosen this goal? Try to set a goal that has meaning for you. This means the goal reflects what you think is important and enjoy, and not necessarily what a parent or doctor told you to do. For example, you might set a goal to walk 1km because *you think being physically active is important*.

Daily details

Breaking down your goals into daily challenges can help you to organise your week and achieve your goals. Write down the details of what you plan to do and when this will fit into your week.

How much/how long you want to do the task/activity (e.g., *1km of walking or 20 minutes*).

Day and time planned for doing the task/activity (e.g., *Tuesday at 7.00 p.m.*).

Challenging (C)

Challenging means setting goals you find difficult but "do-able", while avoiding goals you think are "too easy" to meet. If you set a challenging goal and achieve it, then this helps you to build up confidence about doing the task/activity and helps you to reach your goals in the future. There is a column on your goals sheet for rating the challenge of each task/activity you choose. The scale goes from 0-10 with 0 being no challenge at all and 10 being impossible.

Experiencing obstacles

While trying to reach your goals, you might come across barriers or obstacles which make achieving your goal more difficult. For example, you might feel overwhelmed with school work and find that you are too busy to fit in time for a walk. Instead of viewing these barriers as limiting what you can do, try to think back to the reasons why you need to overcome these barriers (e.g., *the reasons above for setting your goals*) and then work out how you will overcome these barriers.

Helpful Hints

ONE serving size is equal to:

Fruit	Vegetables	Junk food
1 medium piece eg/ apple, banana, orange 2 small pieces eg/ apricot, plum 1 cup diced or tinned fruit ½ cup juice 1½ tbsp dried fruit eg/ sultanas, 4 apricot halves   	½ cup cooked vegetables ½ cup beans or lentils 1 cup salad vegies 1 medium potato   	1 plain doughnut ½ small bar of chocolate (25g) 1 tbsp butter/margarine/oil 2tbsp cream/mayonnaise 2tbsp jam/sugar/honey 1 can soft drink 12 hot chips 1 small packet (30g) crisps 1 ½ scoops ice cream 1 ½ chocolate biscuits 4 plain biscuits    

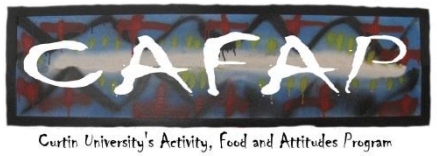
Approximate portion sizes: 1 cup = fist size; 1 tbsp = thumb tip; 1 tsp = fingertip.

Leisure screen (sedentary behaviour) the amount of time you spend doing activities such as playing video games, watching TV, and using the computer.

Moderate-to-vigorous Physical Activity (MVPA) means the amount of time you spend in physical activities that make you huff and puff such as playing a ball game, jogging, fast walking, and fast cycling.

Steps refer the number of steps you walk each day. This includes incidental activity (e.g., walking to the bus stop) and moderate-to-vigorous physical activity (MVPA).

Some examples of ways to meet your weekly goals



Physical activity	Sedentary behaviour	Healthy eating
Active play in the park – kicking a ball.	Watch only my 1 or two favourite TV shows today (name shows)	Have a healthy breakfast
Walk or cycle to and from school	Move the TV out of my bedroom into a family room.	Eat a home cooked dinner (not fast food)
Cycle over to a friends place rather than get a lift in a car	Do an exercise station every ad break when watching TV.	Help cook dinner
Take the dog for a walk	Moving my computer out of my bedroom into a family room.	Eat dinner with my family
Meet a friend for active play	Walk over to talk with my friend _____ rather than chatting on IM/Facebook.	Eat dinner at the table (away from TV)
Active play with parent or brother/sister	Set an egg time to limit by electronic game play to 30 minutes today.	Take a homemade lunch to school
Do active chores like mowing lawn	Limit my electronic game playing to non-school days.	Drink water instead of juice/soft drink
Get a job delivering leaflets/newspapers	Replace sitting electronic game with active one like Move/Kinect	Have fruit for a snack
Do a dance/martial arts class		Have some vegies with my meal

Teenager Overall Goals

CAFAP Habits Matrix

	0	1	2	3	4	5	6	7	8	9	10
Physical Activity											
MVPA	0 mins	10mins 3 x wk	20mins 3 x wk	30mins 3 x wk 20 mins 4-5 x wk	30mins 4-5 x wk 45 mins 3-4 x wk	30 mins 6-7 x wk	60mins 3 x wk	45 mins 4-5 x wk	60 mins 4-5 x wk	45 mins 6-7 x wk	60+mins 6-7 x wk
Steps (average daily steps per week)	<1,000	~2,000	>3,000	>4,000	>5,000	>6,000	>7,000	>8,000	>9,000	>10,000	>12,000
Sedentary Behaviour (Average daily amount per week)											
Leisure screen	>5 hrs	~5 hrs	<4.5 hrs	<4 hrs		<3.5 hrs		< 3hrs		<2.5 hrs	<2hrs
Healthy Eating (Average daily serves per week)											
Fruit serves/ day	0		0.5			1		1.5			2+
Vegetable serves/ day	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5+
Junk food serves/day	5+	<4.5	<4	<3.5	<3	<2. 5	<2	<1.5	<1	<0.5	0

Grey indicates the national average for teens. Put a square around where you are now, and a circle around where you would like to be at the end of CAFAP (in four weeks).

Example of Teenager Weekly Goals – what your goals might be for week 4

	Physical Activity				Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	**My goal this week is:** *To be moderately active for 15 minutes 4 times/ week and do more than 8000 steps 4 times/ week.* **C:** *8* **What do you want to happen by achieving your goal?** **I want**: *To be more physically active.* **Why is it important you achieve this goal?** **Because:** *I enjoy playing sports with my friends and walking with my mum.*			Overall progress Weekly progress	**My goal this week is:** *To reduce screen time by 30 minutes on 3 weekdays and 1 weekend day.* **C:** *7* **What do you want to happen by achieving your goal?** **I want:** *To improve my physical health.* **Why is it important you achieve this goal?** **Because:** *I value looking good for myself.*	Overall progress Weekly progress	**My goal this week is to eat:** **C:** 7 **Fruit**: .6 ≥ s; **Veg**: .6 ≥ s; **JF**: 3 ≤ s **What do you want to happen by achieving your goal?** **I want:** *To feel healthy on the inside.* **Why is it important you achieve this goal?** **Because:** *I enjoy how I feel when I eat healthy*	Overall progress Weekly progress
		C	Goal Steps	Actual Steps		**C**		**C**
Fri	---	--	6,500		*Maximum two hours of screen time: watch only Gossip Girl and Neighbours, play 1 hour of video games (Wii, DS, Xbox, PSP, Gameboy)*	6	*Eat homemade dinner with 2 vegetables*	7
Sat	*Walk 1km 2.00 to 2.30 p.m.* *Bike ride with mum 9-10 am*	7 5	9,000		*Maximum three hours of screen time: Facebook: 4.00 to 4.30, 5.00 to 6.00 video games, 7.30 to 9.00 TV*	7	*Eat maximum 2 serves of junk food*	7
Sun	---	--	6,500		---	--	*Eat 1 piece of fruit at breakfast* *Eat 1 piece of fruit (snack before lunch)*	6 6
Mon	*Walk to and from school (rather than taking a lift by car)*	7	7,500		*Max two hours of screen time: watch only Hawaii 50 and Glee and spend 20 mins Facebook during commercial breaks*	6	*Eat 1 piece fruit at breakfast*	5
Tue	*CAFAP exercise session*	6	8,000		---	--	*Eat homemade dinner with 2 vegetables*	7
Wed	*Soccer with friends 6.30 p.m. to 7.00 p.m.*	6	8,500		---	--	---	--
Th	*CAFAP exercise session*	6	8,000		*Eat dinner with family at dining room table (not in front of TV)*	6	*Eat 1 piece fruit at breakfast* *Eat 1 piece of fruit (homemade lunch)*	6 6

Adolescent Week 4 Goals

	Physical Activity			Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	My goal this week is: _____ _____ C:__ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____		Overall progress Weekly progress	My goal this week is: _____ _____ C:__ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to eat: C:__ Fruit: ___ ≥ s; Veg: ___ ≥ s; JF: ___ ≤ s What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress
		Goal Steps	Actual Steps				
Fri							
Sat							
Sun							
Mon							
Tue							
Wed							
Th							

Adolescent Week 5 Goals

	Physical Activity			Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	My goal this week is: _____ _____ C:__ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____		Overall progress Weekly progress	My goal this week is: _____ _____ C:__ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to eat: C:__ Fruit: ___ ≥ s; Veg: ___ ≥ s; JF: ___ ≤ s What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress
		Goal Steps	Actual Steps				
Fri							
Sat							
Sun							
Mon							
Tue							
Wed							
Th							

Adolescent Week 6 Goals

	Physical Activity			Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	My goal this week is: _____ _____ C:__ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____		Overall progress Weekly progress	My goal this week is: _____ _____ C:__ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to eat: C:__ Fruit: ___ ≥ s; Veg: ___ ≥ s; JF: ___ ≤ s What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress
		Goal Steps	Actual Steps				
Fri							
Sat							
Sun							
Mon							
Tue							
Wed							
Th							

Adolescent Week 7 Goals

	Physical Activity			Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	My goal this week is: _____ _____ C:__ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____		Overall progress Weekly progress	My goal this week is: _____ _____ C:__ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to eat: C:__ Fruit: ___≥ s; Veg: ___≥ s; JF: ___ ≤ s What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress
		Goal Steps	Actual Steps				
Fri							
Sat							
Sun							
Mon							
Tue							
Wed							
Th							

Appendix S
Parent Goal Setting Booklet

PARENT

CAFAP

GOAL SETTING

BOOKLET

Setting Goals for My Future - Parents

Setting goals can help you to change your behaviour and achieve the things you want to do in your life. You may do this by writing down what you want to accomplish and how you will carry out your plan. Below are guidelines you might want to consider when setting goals.

Overall goals

Setting overall goals for longer periods of time (eg/ by the end of CAFAP or for 3 months' time) is useful to help you to achieve things that might take a bit longer to do.

Weekly goals

Setting weekly goals helps to break down your overall goals into smaller and more achievable chunks. These should be goals that, with a bit of effort, you can realistically achieve in a week.

Specific

When you set your goals, try to write them as clearly as you can to make it easier to know when you've reached your goal. On your goal setting sheet, there are three sections to record your different goals. There is one for supporting your teenager's physical activity, one for sedentary behaviour and one for healthy eating. You can write your weekly goal at the top of each column.

Reasons

After you've written your goal it can be a good idea to state your reasons for choosing this goal, which may help you to achieve it. The reasons you have for choosing a goal often influence your motivation to change your behaviour and ultimately reach your goal. The two reasons you might want to consider are:

What do you want to happen as a result of reaching your goal? Or what are you aiming to improve by achieving your goal? For example, are you striving to *improve your teenager's health and fitness* or for *them to look more attractive*? If you set goals focused on improving your teenager's health instead of things other assess such as appearance, it is more likely that you will achieve your goal.

Why is this important that you achieve this goal? Or why have you chosen this goal? Try to set a goal that has meaning for you. This means the goal reflects what you think is important and enjoy, and not necessarily what a doctor or significant other has told you to do. For example, you might set a goal to have family walks for 1km because *you value your teenager being physically active*.

Daily details

Breaking down your goals into daily challenges can help you to organise your week and achieve your goals. Write down the details of what you plan to do and when this will fit into your week.

How much/how long you want to do the task/activity (e.g., *1km of family walks or 20 minutes*).

Day and time planned for doing the task/activity (e.g., *Tuesday at 7.00 p.m.*).

Challenging (C)

Challenging means setting goals you find difficult but "do-able", while avoiding goals you think are "too easy" to meet. If you set a challenging goal and achieve it, then this helps you to build up confidence about doing the task/activity and helps you to reach your goals in the future.

There is a column on your goals sheet for rating the challenge of each task/activity you choose. The scale goes from 0-10 with 0 being no challenge at all and 10 being impossible.

Experiencing obstacles

While trying to reach your goals, you might come across barriers or obstacles which make achieving your goal more difficult. For example, you might feel overwhelmed with work and find that you are too busy to fit in time for a walk. Instead of viewing these barriers as limiting what you can do, try to think back to the reasons why you need to overcome these barriers (e.g., *the reasons above for setting your goals*) and then work out how you will overcome these barriers.

Helpful Hints

ONE serving size is equal to:

Fruit	Vegetables	Junk food
1 medium piece eg/ apple, banana, orange 2 small pieces eg/ apricot, plum 1 cup diced or tinned fruit ½ cup juice 1½ tbsp dried fruit eg/ sultanas, 4 apricot halves 	½ cup cooked vegetables ½ cup beans or lentils 1 cup salad vegies 1 medium potato   	1 plain doughnut ½ small bar of chocolate (25g) 1 tbsp butter/margarine/oil 2tbsp cream/mayonnaise 2tbsp jam/sugar/honey 1 can soft drink 12 hot chips 1 small packet (30g) crisps 1 ½ scoops ice cream 1 ½ chocolate biscuits 4 plain biscuits    

Approximate portion sizes: 1 cup = fist size; 1 tbsp = thumb tip; 1 tsp = fingertip.

Leisure screen (sedentary behaviour) the amount of time spent doing activities such as playing video games, watching TV, and using the computer.

Moderate-to-vigorous Physical Activity (MVPA) means the amount of time spent in physical activities that make you huff and puff such as playing a ball game, jogging, fast walking, and fast cycling.

Steps refer the number of steps walked each day. This includes incidental activity (e.g., walking to the bus stop) and moderate-to-vigorous physical activity (MVPA).

Some examples of ways to meet your weekly goals

Physical activity	Sedentary behaviour	Healthy eating
Play in the park with my teen – kicking a ball	Provide activity for my teen to do after they finish watching their 1 hour of TV	Have a healthy breakfast ready for my teen
Encourage my teen to walk to school rather than providing a lift	Assist my teen to move TV out of their bedroom and into the family room	Pre-plan a home cooked dinner (not fast food)
Encourage my teen to cycle to a friend's house rather than provide a lift	Do an exercise station with my teen every ad break when watching TV together	Set the table for a family dinner
Take the dog for a walk with my teen	Assist my teen to move computer out of their bedroom and into the family room	Turn the TV off at mealtime for everyone
Provide environment to encourage my teen's active play with siblings (e.g., footy to kick)	Store away my teen's electronic game sets during weekdays	Talk to my teen about what sort of fruit they want me to buy at the shops
Attend gym class with my teen	Allow my teen to walk over to talk to a friend rather than chatting on IM/Facebook.	Help my teen make a packed lunch for school
Assist my teen to join a dance/martial arts class	Provide an egg timer to limit my teen's electronic game play by 30 minutes today	Don't buy soft drink.
Do active chores with my teen like raking leaves	Replace my teen's sitting electronic game with active one like Move/Kinect	Make a fruit-based dessert for the family
Assist my teen in finding an active job delivering leaflets/newspapers		Remind my teen to take a healthy snack for after school sport

Choose a new vegie recipe to try

Teenager Overall Goals Supported by Parent

CAFAP Habits Matrix

	0	1	2	3	4	5	6	7	8	9	10
Physical Activity											
MVPA	0 mins	10mins 3 x wk	20mins 3 x wk	30mins 3 x wk 20 mins 4-5 x wk	30mins 4-5 x wk 45 mins 3-4 x wk	30 mins 6-7 x wk	60mins 3 x wk	45 mins 4-5 x wk	60 mins 4-5 x wk	45 mins 6-7 x wk	60+mins 6-7 x wk
Steps (average daily steps per week)	<1,000	~2,000	>3,000	>4,000	>5,000	>6,000	>7,000	>8,000	>9,000	>10,000	>12,000
Sedentary Behaviour (Average daily amount per week)											
Leisure screen	>5 hrs	~5 hrs	<4.5 hrs	<4 hrs		<3.5 hrs		< 3hrs		<2.5 hrs	<2hrs
Healthy Eating (Average daily serves per week)											
Fruit serves/ day	0		0.5			1		1.5			2+
Vegetable serves/ day	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5+
Junk food serves/day	5+	<4.5	<4	<3.5	<3	<2. 5	<2	<1.5	<1	<0.5	0

Grey indicates the national average for teens. Put a square around where your teen is now, and a circle around where they would like to be at the end of CAFAP (in four weeks).

Example of Parent Weekly Goals – what your goals might be for week 4

	Physical Activity		Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	**My goal this week is to support my teen's goal to:** *Be moderately active for 15 minutes 4 times/ week and do more than 8000 steps 4 times/ week* **What do you want to happen by achieving your goal?** **I want**: *My teen to be more physically active.* **Why is it important you achieve this goal?** **Because:** *I enjoy being active with my teen and seeing them be active with their friends.*	Overall progress Weekly progress	**My goal this week is to support my teen's goal to:** *Reduce screen time by 30 minutes on 3 weekdays and 1 weekend day.* **What do you want to happen by achieving your goal?** **I want:** *To improve my teen's physical health* **Why is it important you achieve this goal?** **Because:** *I value my teen feeling phy. healthy*	Overall progress Weekly progress	**My goal this week is to support my teen's goal to eat:** **Fruit**: .6 ≥ s; **Veg**: .6 ≥ s; **JF**: 3 ≤ s **What do you want to happen by achieving your goal?** **I want:** *Improve teen's healthy food choices* **Why is it important you achieve this goal?** **Because:** *I value my teenager feeling healthy on the inside.*	Overall progress Weekly progress
		C		C		C
Fri	---	--	*Organise a family dog walk after dinner to help my teen not exceed ST time (2hrs)*	6	*Cook homemade dinner with 2 serves of vegetables*	7
Sat	*Family walk 1km: 2.00 – 2.30* *Mum and child only bike ride: 9.00 - 10.00*	6 7	*Provide choices for active behaviours my teen and I can do if I notice they've exceeded their ST time (3hrs)*	8	---	--
Sun	---	--	---	--	*Remind my teen to set their alarm early enough to wake up and eat breakfast on Monday*	5
Mon	*Allow my teen to walk to and from school (don't provide lift by car)*	7	*Organise a family dog walk after dinner to help my teen not exceed ST time (2hrs)*	6	---	--
Tue	*Bring to CAFAP exercise session*	6	---	--	*Cook homemade dinner with 2 serves of vegetables*	7
Wed	*Allow my teen to walk to neighbourhood park and play soccer with friends 6.30 p.m. to 7.00 p.m.*	5	---	--	*Help my teen make their lunch tonight to eat at school tomorrow*	7
Th	*Bring to CAFAP exercise session*	6	*Eat dinner with family at dining room table (not in front of TV)*	6	*Grocery store shop tonight: buy my teen's favourite fruit, healthy breakfast and lunch food, broccoli, carrot, salad ingredients*	6

Parent Week 4 Goals

	Physical Activity		Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	My goal this week is to support my teen's goal to: _____ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to support my teen's goal to: _____ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to support my teen's goal to eat: Fruit: __ ≥ s; Veg: __ ≥ s; JF:__ ≤ s What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress
		C		C		C
Fri						
Sat						
Sun						
Mon						
Tue						
Wed						
Th						

Parent Week 5 Goals

	Physical Activity		Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	My goal this week is to support my teen's goal to: _____ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to support my teen's goal to: _____ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to support my teen's goal to eat: Fruit: __ ≥ s; Veg: __ ≥ s; JF:__ ≤ s What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress
		C		C		C
Fri						
Sat						
Sun						
Mon						
Tue						
Wed						
Th						

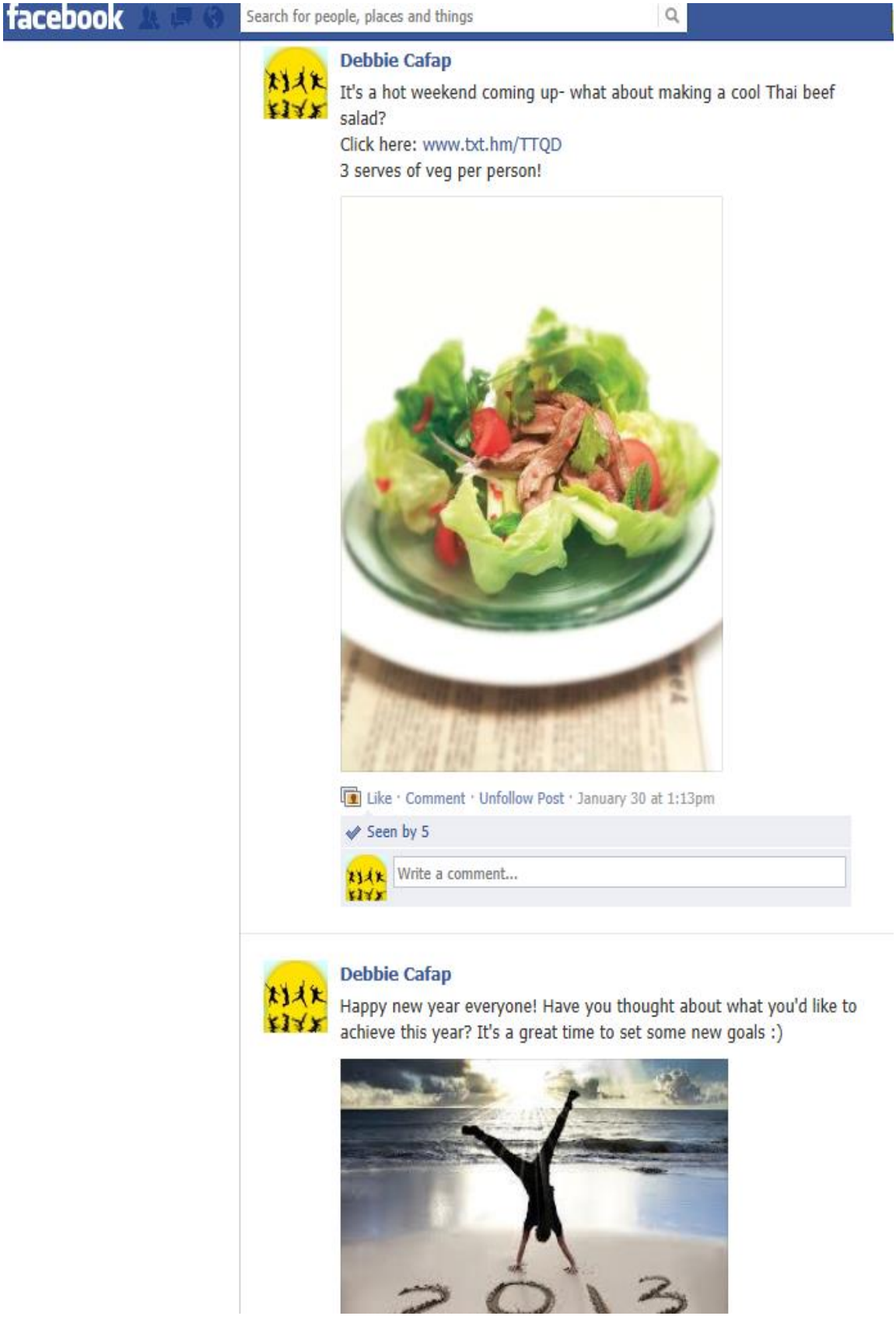
Parent Week 6 Goals

	Physical Activity		Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	My goal this week is to support my teen's goal to: _____ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to support my teen's goal to: _____ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to support my teen's goal to eat: Fruit: __ ≥ ≤; Veg: __ ≥ ≤; JF:__ ≤ ≤ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress
		C		C		C
Fri						
Sat						
Sun						
Mon						
Tue						
Wed						
Th						

Parent Week 7 Goals

	Physical Activity		Sedentary Behaviour		Healthy Eating	
Weekly goal Reasons for your weekly goal	My goal this week is to support my teen's goal to: _____ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to support my teen's goal to: _____ What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress	My goal this week is to support my teen's goal to eat: Fruit: __ ≥ s; Veg: __ ≥ s; JF:__ ≤ s What do you want to happen by achieving your goal? I want:_____ _____ Why is it important you achieve this goal? Because:_____ _____	Overall progress Weekly progress
		C		C		C
Fri						
Sat						
Sun						
Mon						
Tue						
Wed						
Th						

Appendix T
CAFAP Facebook Page



Appendix U
CAFAP Website

About | CAFAP 2012 | Join | Success stories | FAQs

About

The Curtin University Activity, Food and Attitudes Program (CAFAP) is a free eight-week healthy lifestyle program for overweight 12 to 16 years olds that includes families in the approach to changing lifestyles and creating healthy lifelong habits. This means that both parents and teenagers are involved in CAFAP.

CAFAP has been running at Curtin University since 2009 and is now moving into local communities. It is run by a multidisciplinary team of health professionals including dietitians, physiotherapists, social workers and psychologists.

CAFAP focuses on the development of lifelong healthy habits rather than weight loss, to help teenagers stay in control of their weight for the rest of their lives.

Teenagers
is this program right for you?

Parents
is this program right for them?

Appendix V

Rater Observation Sheet

Rater:
Instructor:
Session No.:

Location: South Metro East Metro Regional
Cohort: 1 2 3
Participants: Parents Adolescents Both

Instructor's **Autonomy Support**

Relies on Extrinsic Motivational Resources								**Nurtures Intrinsic Motivational Resources**								**Neglects Values, Importance of Task/Lesson/Behaviour**								**Identifies Value, Importance of Task/Lesson/Behaviour**
• Uses discouraging statements	1	2	3	4	5	6	7	• Offers encouragement								• Neglects meaningful rational (benefits, value)	1	2	3	4	5	6	7	• Provides meaningful rational (benefits, value)
• Provides negative feedback	1	2	3	4	5	6	7	• Provides positive feedback																
• Monopolizes behaviour tasks	1	2	3	4	5	6	7	• Allows Ps to engage in tasks as personally desired								**Reaction to Negative Affect:**								
																Is Not OK: Change It								**Is OK: Listens, Accepts**
Controlling Language								**Informational Language**								• Disinterest in Ps' responses	1	2	3	4	5	6	7	• Spends time listening to Ps
• Should, must, have to, got to	1	2	3	4	5	6	7	• May, could								• Excludes time for Ps to talk (excluding group work)	1	2	3	4	5	6	7	• Allows time for Ps to talk (excluding group work)
• Asks controlling questions	1	2	3	4	5	6	7	• Asks supportive questions								• Disregards Ps' questions	1	2	3	4	5	6	7	• Responsive to Ps' questions
• Uses directives/commands	1	2	3	4	5	6	7	• Avoids directives/commands								• Tries to fix, counter, or change into something else	1	2	3	4	5	6	7	• Takes Ps' perspective, shows empathy and validation

Instructor's **Involvement**

Seems Cold, Closed								**Seems Warm, Open**								**Knows Participants: No, Not at all**								**Knows Participants: Yes, Detailed Knowledge**
• Business-like	1	2	3	4	5	6	7	• Expresses affection, caring								• No mention of names, personal histories	1	2	3	4	5	6	7	• Knows names, personal histories
• Doesn't enjoy time with Ps	1	2	3	4	5	6	7	• Does enjoy time with Ps																
Withholds Personal Resources								**Invests Personal Resources**																
• Time, attention, energy	1	2	3	4	5	6	7	• Time, attention, energy																
Physical Proximity: Distant								**Physical Proximity: Close**																
• Keeps distance	1	2	3	4	5	6	7	• Walks over to Ps																
• Stays up front during sessions	1	2	3	4	5	6	7	• Stands near/sits close																

Goals

<u>Delivered content emphasising:</u>														
• Others' values/enjoyment	1	2	3	4	5	6	7	• Participants' values/enjoyment						
• Appearance related outcomes	1	2	3	4	5	6	7	• Health related outcomes						
<u>Encouraged participants to set:</u>														
• Goals others value	1	2	3	4	5	6	7	• Goals they value/enjoy						
• Appearance related goals	1	2	3	4	5	6	7	• Health related goals						

Instructor's **Structure**

<u>During Introduction/Directions:</u>														
Absent, confusing, unclear								**Clear, understandable, detailed**						
• Little or no organization	1	2	3	4	5	6	7	• Clear organization						
• Procedures are absent, confusing, complicated	1	2	3	4	5	6	7	• Clearly stated procedures						
<u>During lesson/while Ps learn:</u>														
• Fails to show leadership	1	2	3	4	5	6	7	• Organized, leader, conductor						
• No plan, no goals	1	2	3	4	5	6	7	• Clear plan, clear goals						
Low, Easy Tasks								**High, Difficult Tasks**						
• Little challenge	1	2	3	4	5	6	7	• Much challenge						
• Asks for only small capacity	1	2	3	4	5	6	7	• Asks for full capacity						
Scaffolding is Fully Absent								**Scaffolding is Richly Present**						
• Lack of: hints, clues, tips	1	2	3	4	5	6	7	• Hints, clues, tips, reminders						
<u>During Feedback, Post Performance Commentary:</u>														
None, ambiguous, off-task, rambling	1	2	3	4	5	6	7	**Skill-building, informative, Instructive**						

CAFAP Fidelity

Program vastly differs from program content	1	2	3	4	5	6	7	**Program closely matches program content**						

Appendix W

Instructor Self-Report Need-Supportive Behaviours

Please indicate the degree to which you felt you implemented the following behaviours during the intervention sessions.

	Not true at all true			**Very true**
Provided options for physical activity and healthy eating behaviours	1	2	3	4
Provided positive feedback to participants	1	2	3	4
Used non-controlling language (e.g., “may”; “could”)	1	2	3	4
Provided meaningful rational for physical activity and healthy eating behaviours	1	2	3	4
Spent time listening to participants	1	2	3	4
Took participants’ perspective and showed empathy	1	2	3	4
Expressed affection and care toward participants	1	2	3	4
Invested attention and energy in participants’ progress	1	2	3	4
Remained in close proximity to participants	1	2	3	4
Learned the participants’ names and personal histories	1	2	3	4
Clearly stated procedures	1	2	3	4
Explained clear goals for each session	1	2	3	4
Provided optimally challenging tasks for participants	1	2	3	4
Provided helpful hints and reminders for participants	1	2	3	4
Offered instructive and informative feedback to participants	1	2	3	4

Appendix X

Instrument: Adolescent Perceptions of Instructor Support (Physical Activity)

This section asks you to reflect on the behaviours demonstrated by the instructor with regard to your physical activity during CAFAP. Please indicate the degree to which you agree with the following statements.

Remember: Physical activity is defined as moderate intensity movement that makes you huff, puff, and sweat.

	Strongly disagree						**Strongly agree**
I felt the instructor provided me with choices, options, and opportunities about whether to do physical activity	1	2	3	4	5	6	7
The instructor encouraged me to do physical activity	1	2	3	4	5	6	7
The instructor provided me with positive feedback when I did physical activity	1	2	3	4	5	6	7
The instructor made sure I understood why I needed to do physical activity	1	2	3	4	5	6	7
I think the instructor understood my choices for doing physical activity	1	2	3	4	5	6	7
The instructor was concerned about my well-being experiences when I did physical activity	1	2	3	4	5	6	7
The instructor cared about the physical activity I did	1	2	3	4	5	6	7
The instructor listened to me about the physical activity I did	1	2	3	4	5	6	7
I felt I was able to share my experiences of physical activity with the instructor	1	2	3	4	5	6	7
The instructor displayed confidence in my ability to do physical activity	1	2	3	4	5	6	7
The instructor gave me good advice about the physical activity I did	1	2	3	4	5	6	7
The instructor gave me clear and understandable instructions about doing physical activity	1	2	3	4	5	6	7
The instructor made it clear to me what to expect from doing physical activity	1	2	3	4	5	6	7
The instructor provided clear answers to my questions about doing physical activity	1	2	3	4	5	6	7

Appendix Y

Instrument: Parent Perceptions of Instructor Support (Physical Activity)

This section asks you to reflect on the behaviours demonstrated by the instructor with regard to supporting your adolescent's physical activity during CAFAP. Please indicate the degree to which you agree with the following statements.

Remember: Physical activity is defined as moderate intensity movement that makes you huff, puff, and sweat.

	Strongly disagree						**Strongly agree**
I felt the instructor provided me with choices, options, and opportunities about whether to support my adolescent's physical activity	1	2	3	4	5	6	7
The instructor encouraged me to support my adolescent's physical activity	1	2	3	4	5	6	7
The instructor provided me with positive feedback when I supported my adolescent's physical activity	1	2	3	4	5	6	7
The instructor made sure I understood why I needed to support my adolescent's physical activity	1	2	3	4	5	6	7
I think the instructor understood my choices for supporting my adolescent's physical activity	1	2	3	4	5	6	7
The instructor was concerned about my well-being experiences when I supported my adolescent's physical activity	1	2	3	4	5	6	7
The instructor cared about what I did to support my adolescent's physical activity	1	2	3	4	5	6	7
The instructor listened to me about supporting my adolescent's physical activity	1	2	3	4	5	6	7
I felt I was able to share my experiences of supporting my adolescent's physical activity with the instructor	1	2	3	4	5	6	7
The instructor displayed confidence in my ability to support my adolescent's physical activity	1	2	3	4	5	6	7
The instructor gave me good advice about what I did to support my adolescent's physical activity	1	2	3	4	5	6	7
The instructor gave me clear and understandable instructions about supporting my adolescent's physical activity	1	2	3	4	5	6	7
The instructor made it clear to me what to expect from supporting my adolescent's physical activity	1	2	3	4	5	6	7
The instructor provided clear answers to my questions about supporting my adolescent's physical activity	1	2	3	4	5	6	7

Appendix Z

Instrument: Adolescent Perceptions of Instructor Support (Health Eating)

This section asks you to reflect on the behaviours demonstrated by the instructor with regard to your healthy eating during CAFAP. Please indicate the degree to which you agree with the following statements.

Remember: Eating healthy is defined as sufficient fruit and vegetables and few high fat foods.

	Strongly disagree						**Strongly agree**
I felt the instructor provided me with choices, options, and opportunities about whether to eat healthy	1	2	3	4	5	6	7
The instructor encouraged me to eat healthy	1	2	3	4	5	6	7
The instructor provided me with positive feedback about eating healthy	1	2	3	4	5	6	7
The instructor made sure I understood why I needed to eat healthy	1	2	3	4	5	6	7
I think the instructor understood my choices for eating healthy	1	2	3	4	5	6	7
The instructor was concerned about my well-being experiences when I ate healthy	1	2	3	4	5	6	7
The instructor cared about the healthy eating I did	1	2	3	4	5	6	7
The instructor listened to me about my eating healthy	1	2	3	4	5	6	7
I felt I was able to share my experiences of eating healthy with the instructor	1	2	3	4	5	6	7
The instructor displayed confidence in my ability to eat healthy	1	2	3	4	5	6	7
The instructor gave me good advice about eating healthy	1	2	3	4	5	6	7
The instructor gave me clear and understandable instructions about eating healthy	1	2	3	4	5	6	7
The instructor made it clear to me what to expect from eating healthy	1	2	3	4	5	6	7
The instructor provided clear answers to my questions about eating healthy	1	2	3	4	5	6	7

Appendix AA

Instrument: Parent Perceptions of Instructor Support Behaviour (Healthy Eating)

This section asks you to reflect on the behaviours demonstrated by the instructor with regard to supporting your adolescent's healthy eating during CAFAP. Please indicate the degree to which you agree with the following statements.

Remember: Eating healthy is defined as sufficient fruit and vegetables and few high fat foods.

	Strongly disagree						**Strongly agree**
I felt the instructor provided me with choices, options, and opportunities about whether to support my adolescent's healthy eating	1	2	3	4	5	6	7
The instructor encouraged me to support my adolescent's healthy eating	1	2	3	4	5	6	7
The instructor provided me with positive feedback about supporting my adolescent's healthy eating	1	2	3	4	5	6	7
The instructor made sure I understood why I needed to support my adolescent's healthy eating	1	2	3	4	5	6	7
I think the instructor understood my choices for supporting my adolescent's healthy eating	1	2	3	4	5	6	7
The instructor was concerned about my well-being experiences when I supported my adolescent's healthy eating	1	2	3	4	5	6	7
The instructor cared about what I did to support my adolescent's healthy eating	1	2	3	4	5	6	7
The instructor listened to me about supporting my adolescent's healthy eating	1	2	3	4	5	6	7
I felt I was able to share my experiences of supporting my adolescent's healthy eating with the instructor	1	2	3	4	5	6	7
The instructor displayed confidence in my ability to support my adolescent's healthy eating	1	2	3	4	5	6	7
The instructor gave me good advice about supporting my adolescent's healthy eating	1	2	3	4	5	6	7
The instructor gave me clear and understandable instructions about supporting my adolescent's healthy eating	1	2	3	4	5	6	7
The instructor made it clear to me what to expect from supporting my adolescent's healthy eating	1	2	3	4	5	6	7
The instructor provided clear answers to my questions about supporting my adolescent's healthy eating	1	2	3	4	5	6	7

Appendix BB

Instrument: Adolescent Autonomous Motivation (Healthy Eating)

This section asks you to reflect on the behaviours demonstrated by your parent in regard to your physical activity. When answering the questions, please refer to your parent who plans to attend the majority of the CAFAP sessions. Please indicate the degree to which you agree with the following statements.

Remember: Physical activity is defined as moderate intensity movement that makes you huff, puff, and sweat.

	Strongly disagree						**Strongly agree**
I felt my parent provided me with choices, options, and opportunities about whether to do physical activity	1	2	3	4	5	6	7
My parent encouraged me to do physical activity	1	2	3	4	5	6	7
My parent provided me with positive feedback when I did physical activity	1	2	3	4	5	6	7
My parent made sure I understood why I needed to do physical activity	1	2	3	4	5	6	7
I think my parent understood my choices for doing physical activity	1	2	3	4	5	6	7
My parent was concerned about my well-being experiences when I did physical activity	1	2	3	4	5	6	7
My parent cared about the physical activity I did	1	2	3	4	5	6	7
My parent listened to me about the physical activity I did	1	2	3	4	5	6	7
I felt I was able to share my experiences of physical activity with my parent	1	2	3	4	5	6	7
My parent displayed confidence in my ability to do physical activity	1	2	3	4	5	6	7
My parent gave me good advice about the physical activity I did	1	2	3	4	5	6	7
My parent gave me clear and understandable instructions about doing physical activity	1	2	3	4	5	6	7
My parent made it clear to me what to expect from doing physical activity	1	2	3	4	5	6	7
My parent provided clear answers to my questions about doing physical activity	1	2	3	4	5	6	7

Appendix CC

Instrument: Adolescent Perceived Parent Support (Physical Activity)

This section asks you to reflect on the behaviours demonstrated by your parent in regard to your healthy eating. When answering the questions, please refer to your parent who plans to attend the majority of the CAFAP sessions. Please indicate the degree to which you agree with the following statements.

Remember: Eating healthy is defined as sufficient fruit and vegetables and few high fat foods.

	Strongly disagree						**Strongly agree**
I felt my parent provided me with choices, options, and opportunities about whether to eat healthy	1	2	3	4	5	6	7
My parent encouraged me to eat healthy	1	2	3	4	5	6	7
My parent provided me with positive feedback about eating healthy	1	2	3	4	5	6	7
My parent made sure I understood why I needed to eat healthy	1	2	3	4	5	6	7
I think the my parent understood my choices for eating healthy	1	2	3	4	5	6	7
My parent was concerned about my well-being experiences when I ate healthy	1	2	3	4	5	6	7
My parent cared about the healthy eating I did	1	2	3	4	5	6	7
My parent listened to me about my eating healthy	1	2	3	4	5	6	7
I felt I was able to share my experiences of eating healthy with my parent	1	2	3	4	5	6	7
My parent displayed confidence in my ability to eat healthy	1	2	3	4	5	6	7
My parent gave me good advice about eating healthy	1	2	3	4	5	6	7
My parent gave me clear and understandable instructions about eating healthy	1	2	3	4	5	6	7
My parent made it clear to me what to expect from eating healthy	1	2	3	4	5	6	7
My parent provided clear answers to my questions about eating healthy	1	2	3	4	5	6	7

Appendix DD

Instrument: Adolescent Autonomous Motivation (Physical Activity)

In this section you will be presented with reasons why you do physical activity. You are asked to indicate how true each reason is for you.

Remember: Physical activity is defined as moderate intensity movement that makes you huff, puff, and sweat.

I do physical activity because…	Not true at all			Very true
…significant others tell me that I should	1	2	3	4
…I feel guilty when I don't	1	2	3	4
…I value the benefits of regularly doing physical activity	1	2	3	4
…it's fun	1	2	3	4
…I don't see why I should have to do physical activity	1	2	3	4
…my friends/family/partner say I should	1	2	3	4
…I feel ashamed when I miss a physical activity session	1	2	3	4
…it's important to me to regularly do physical activity	1	2	3	4
…I can't see why I should bother doing physical activity	1	2	3	4
…I enjoy my physical activity sessions	1	2	3	4
…others will not be pleased if I don't	1	2	3	4
…I don't see the point in doing physical activity	1	2	3	4
…I feel like a failure when I haven't done any physical activity in a while	1	2	3	4
…I think it's important to make the effort to regularly do physical activity	1	2	3	4
…I find doing physical activity a pleasurable activity	1	2	3	4
…I feel under pressure from my friends/family/partner to do physical activity	1	2	3	4
…I get restless and irritable if I do not regularly do physical activity	1	2	3	4
…I get pleasure and satisfaction from regularly doing physical activity	1	2	3	4
…I think doing physical activity is a waste of time	1	2	3	4
…I gain a lot of benefits that are important to me	1	2	3	4
…it's part of the way in which I have chosen to live my life	1	2	3	4
…it's essential to my identity and sense of self	1	2	3	4
…it's genuinely a part of me	1	2	3	4
…it's consistent with my values, goals, and aims in life	1	2	3	4
…doing physical activity and being myself are inseparable	1	2	3	4

Appendix EE

Instrument: Adolescent Autonomous Motivation (Healthy Eating)

In this section you will be presented with reasons why you eat healthy. You are asked to indicate how true each reason is for you.

Remember: Eating healthy is defined as sufficient fruit and vegetables and few high fat foods.

I do physical activity because…	Not true at all			Very true
…I enjoy eating healthy	1	2	3	4
…I value the benefits of eating healthy	1	2	3	4
...I will feel guilty if I do not eat healthy	1	2	3	4
…others want me to eat healthy	1	2	3	4
…I don't see why I should eat healthy	1	2	3	4
…it's fun to eat healthy	1	2	3	4
….I think it's important to make the effort to regularly eat healthy	1	2	3	4
…I will feel bad with myself if I do not eat healthy	1	2	3	4
…people I know well say I should eat healthy	1	2	3	4
…eating healthy gives me a sense of well-being	1	2	3	4
…I can't see why I should bother eating healthy	1	2	3	4
…it's important to me to eat healthy on a regular basis	1	2	3	4
...I will feel ashamed if I do not eat healthy	1	2	3	4
…I feel under pressure to eat healthy from people I know well	1	2	3	4
…I think eating healthy is a waste of time	1	2	3	4
…it's part of the way in which I have chosen to live my life	1	2	3	4
…I don't see the point in eating healthy	1	2	3	4
…it's an important part of who I am	1	2	3	4
…it's essential to my identity and sense of self	1	2	3	4
…eating healthy is consistent with my deepest principles	1	2	3	4
…it's an extension of me	1	2	3	4

Appendix FF

Instrument: Adolescent Health-Related Quality of Life

These questions are about your life. On the following page is a list of things that might be a problem for you. Please tell us how much of a problem each one has been for you during the past ONE month by circling:

0 if it is never a problem

1 if it is almost never a problem

2 if it is sometimes a problem

3 if it is often a problem

4 if it is almost always a problem

There are no right or wrong answers. If you do not understand a question, please ask for help.

In the past ONE month, how much of a problem has this been for you…?

About my Health and Activities (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
1. It is hard for me to walk more than one block	0	1	2	3	4
2. It is hard for me to run	0	1	2	3	4
3. It is hard for me to do sports activity or exercise	0	1	2	3	4
4. It is hard for me to lift something heavy	0	1	2	3	4
5. It is hard for me to take a bath or shower by myself	0	1	2	3	4
6. It is hard for me to do chores around the house	0	1	2	3	4
7. I hurt or ache	0	1	2	3	4
8. I have low energy	0	1	2	3	4

Continues next page…

In the past ONE month, how much of a problem has this been for you…?

About My Feelings (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
9. I feel afraid or scared	0	1	2	3	4
10. I feel sad or blue	0	1	2	3	4
11. I feel angry	0	1	2	3	4
12. I have trouble sleeping	0	1	2	3	4
13. I worry about what will happen to me	0	1	2	3	4

In the past ONE month, how much of a problem has this been for you…?

How I Get Along With Others (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
14. I have trouble getting along with other teens	0	1	2	3	4
15. Other teens do not want to be my friend	0	1	2	3	4
16. Other teens tease me	0	1	2	3	4
17. I cannot do things that other teens my age can do	0	1	2	3	4
18. It is hard to keep up with my peers	0	1	2	3	4

In the past ONE month, how much of a problem has this been for you…?

About School (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
19. it is hard to pay attention in class	0	1	2	3	4
20. I forget things	0	1	2	3	4
21. I have trouble keeping up with my schoolwork	0	1	2	3	4
22. I miss school because of not feeling well	0	1	2	3	4
23. I miss school to go to the doctor or hospital	0	1	2	3	4

Appendix GG
Instrument: Adolescent Depressive Symptoms

Here are more questions about your attitudes. This questionnaire is about how you might have been feeling or acting *recently*.

For each question, please check ☑ how much you have felt or acted this way *in the past two weeks.*

If a sentence was true about you most of the time, check TRUE.
If it was only sometimes true, check SOMETIMES.
If a sentence was not true about you, check NOT TRUE.

	True	Some-times	Not True
1. I felt miserable or unhappy	☐	☐	☐
2. I didn't enjoy anything at all	☐	☐	☐
3. I felt so tired I just sat around and did nothing	☐	☐	☐
4. I was very restless	☐	☐	☐
5. I felt I was no good anymore	☐	☐	☐
6. I cried a lot	☐	☐	☐
7. I found it hard to think properly or concentrate	☐	☐	☐
8. I hated myself	☐	☐	☐
9. I was a bad person	☐	☐	☐
10. I felt lonely	☐	☐	☐
11. I thought nobody really loved me	☐	☐	☐
12. I thought I could never be as good as other kids	☐	☐	☐
13. I did everything wrong	☐	☐	☐

Appendix HH
Accelerometer Position Wear

Appendix II

Instrument: Adolescent Physical Activity (Self-Report)

Some questions about the ACTIVITIES you do.

The following questions are about activities that would raise your heart rate and make you huff and puff.

In the last 7 days, how **often** did you do the following activities? *Tick one box only for each activity.*

Do sports	1☐ not at all	2☐ 1 x week	3☐ 2-3 x week	4☐ 4-5 x week	5☐ 6-7 x week
Do active play (like playground games and mucking around)	1☐ not at all	2☐ 1 x week	3☐ 2-3 x week	4☐ 4-5 x week	5☐ 6-7 x week
Getting around (like walking, cycling and skating)	1☐ not at all	2☐ 1 x week	3☐ 2-3 x week	4☐ 4-5 x week	5☐ 6-7 x week
Do active chores (like tidying your room gardening)	1☐ not at all	2☐ 1 x week	3☐ 2-3 x week	4☐ 4-5 x week	5☐ 6-7 x week

Appendix JJ

Instrument: Adolescent 3-day Food Diary

CAFAP

Curtin University's Activity, Food and Attitudes Program

FOOD DIARY

Remember:

$10 voucher for a complete and detailed diary!

$5 for a good effort!

Started Diary on _____(date)

Finished Diary on _____(date)

Name: _____

Telephone number: _____

Email: _____

Please call Kyla or Debbie if you have any questions: 9266 3694 or 9266 9456

Office use only

Wave_____ Assessment_____ ID code_____

Guidelines for keeping your 3-day Food Diary

PLEASE RECORD EVERYTHING THAT YOU EAT AND DRINK FOR THREE CONSECUTIVE DAYS.

Choose one weekend day and 2 weekdays

- Record each item as soon as your eat or drink it
- Try to keep the diary with you at mealtimes
- Give a full description of your food or drink
- Record the ***type*** and ***brand*** and ***cooking method*** of each item.
  - *Eg/ chicken breast, no skin, panfried with olive oil*
  - *Eg/ Helga's white bread spread with Flora canola margarine*
- With 'take-aways' please write what they are and where they have been bought.

DESCRIBE THE AMOUNT OF FOOD YOU EAT

- If there is a **weight** on the packet, please write this down
- Do your best to record the amount in household measures (for example: **cups, spoons, volume or tea-spoons**)
- Estimate the **ingredients** of a mixed dish separately
  - *Eg/ a salad with 1 lettuce leaf, ¼ tomato and 3 slices of cucumber lightly dressed with Praise French dressing*
- Remember to include **accompaniments** such as; butter, gravies, salt, butter added to vegetables, milk and sugar in coffee.
- Record all fluids <u>even water</u> and estimate the volume consumed in cups* or mLs. Indicate the size of the cup (eg a middi glass, a paper cup, coffee mug)
- Record all recipes where possible: there is a '*recipes*' section at the end of the booklet

PLEASE REMEMBER TO INDICATE IF THIS IS A NORMAL DAY OR NOT *(eg/ birthday party, sick day, sports carnival)*

This is an example of recording breakfast. See how:

- There is a clear description of all foods
- Brands are recorded where possible
  - Eg/ Brownes Calcium Plus milk
- Types of food are recorded
  - eg/ white sugar
- Amounts are recorded in as much detail as possible

Please put as much detail as you can into your food diary.

A detailed food diary will earn you a **$10 gift voucher**.

A food diary that is not as detailed but still shows the amount of effort you have put in will earn you a **$5 gift voucher**.

Do your very best!

Time	**Example** Food and Drink Consumed	
	Description eg Weetbix	Quantity eg 3 biscuits
7am	*Cornflakes – Kelloggs*	*1.5 cups*
	Milk – Brownes Calcium Plus	*1 cup*
	Sugar - white	*2 tsp*
	Toast, white bread – Helgas	*2 large thick slices*
	Margarine – Flora Light	*3 teaspoons*
	Tea – Lipton	*1 cup*
	Milk – Brownes Skim	*30ml*
	Sugar - white	*3 tsp*

Time	**DAY 1** Food and Drink Consumed	
	Description eg Weetbix	Quantity eg 3 biscuits / 45g

Time	DAY 1 continued... Food and Drink Consumed	
	Description	Quantity

Time	DAY 2 continued... Food and Drink Consumed	
	Description	Quantity
Normal day? Yes/ No Why not?		

Time	DAY 3 Food and Drink Consumed	
	Description eg Weetbix	Quantity eg 3 biscuits / 45g

Time	DAY 3 continued... Food and Drink Consumed	
	Description	Quantity
Normal day? Yes/ No Why not?		

Recipes

Appendix KK

Instrument: Parent Autonomous Motivation (Physical Activity)

In this section you will be presented with reasons why you support your adolescent's physical activity. You are asked to indicate how true each reason is for you.

Remember: Physical activity is defined as moderate intensity movement that makes you huff, puff, and sweat.

I support my adolescent's physical activity because…	**Not true at all**			**Very true**
…significant others tell me that I should	1	2	3	4
…I feel guilty when I don't	1	2	3	4
…I value the benefits of my adolescent regularly doing physical activity	1	2	3	4
…because it's fun	1	2	3	4
…I don't see why I should have to support my adolescent's physical activity	1	2	3	4
…because my friends/partner say I should	1	2	3	4
…I feel guilty when my adolescent misses a physical activity session	1	2	3	4
…it's important to me for my adolescent to regularly do physical activity	1	2	3	4
…I can't see why I should bother supporting my adolescent's physical activity	1	2	3	4
…I enjoy when my adolescent does physical activity sessions	1	2	3	4
…others will not be pleased if I don't	1	2	3	4
…I don't see the point in my adolescent doing physical activity	1	2	3	4
…I feel like a failure when my adolescent hasn't done any physical activity in a while	1	2	3	4
…I think it's important to make the effort to support my adolescent to regularly do physical activity	1	2	3	4
…I find supporting my adolescent's physical activity a pleasurable activity	1	2	3	4
…I feel under pressure from my friends/partner to support my adolescent's physical activity	1	2	3	4
…I get annoyed if my adolescent does not regularly do physical activity	1	2	3	4
…I get pleasure and satisfaction from supporting my adolescent to regularly do physical activity	1	2	3	4
…I think physical activity is a waste of time for my adolescent	1	2	3	4
…I gain a lot of benefits that are important to me	1	2	3	4
…it's part of the way in which I have chosen to live my life	1	2	3	4
…it's essential to my identity and sense of self	1	2	3	4
…it's genuinely a part of me	1	2	3	4
…it's consistent with my values, goals, and aims in life	1	2	3	4
…it's an extension of myself	1	2	3	4

Appendix LL

Instrument: Parent Autonomous Motivation (Healthy Eating)

In this section you will be presented with reasons why you support your adolescent's healthy eating. You are asked to indicate how true each reason is for you.

Remember: Healthy eating is defined as sufficient fruit and vegetables and few high fat foods.

I support my adolescent's healthy eating because…	**Not true at all**			**Very true**
…I enjoy supporting it	1	2	3	4
…I value the benefits of supporting my adolescent's healthy eating	1	2	3	4
...I will feel guilty if I don't	1	2	3	4
…others want me to support my adolescent's healthy eating	1	2	3	4
…I don't see why I should support my adolescent's healthy eating	1	2	3	4
…it's fun to support my adolescent's healthy eating	1	2	3	4
….I think it's important to make the effort to regularly support my adolescent's healthy eating	1	2	3	4
…I will feel bad with myself if I don't support my adolescent's healthy eating	1	2	3	4
…people I know well say I should support my adolescent's healthy eating	1	2	3	4
…it gives me a sense of well-being	1	2	3	4
…I can't see why I should bother supporting my adolescent's healthy eating	1	2	3	4
…it's important to me to regularly support my adolescent's healthy eating	1	2	3	4
...I will feel ashamed if I do not support my adolescent's healthy eating	1	2	3	4
…I feel under pressure from others to support my adolescent's healthy eating	1	2	3	4
…I think supporting my adolescent's healthy eating is a waste of time	1	2	3	4
…it's part of the way in which I have chosen to live my life	1	2	3	4
…I don't see the point in supporting my adolescent's healthy eating	1	2	3	4
…it's an important part of who I am	1	2	3	4
…it's essential to my identity and sense of self	1	2	3	4
…supporting my adolescent in healthy eating is consistent with my deepest principles	1	2	3	4
…it's an extension of me	1	2	3	4

Appendix MM

Instrument: Parent-Report Demonstration of Need-Supportive Behaviours

Please indicate the degree to which you felt you demonstrate the following behaviours within the home environment in regard to your adolescent's physical activity and healthy eating behaviours.

	Not true at all			**Very true**
Provided options for his/her behavior changes	1	2	3	4
Provided positive feedback about his/her goals	1	2	3	4
Used non-controlling language (e.g., "may"; "could")	1	2	3	4
Provided meaningful rational for behaviour changes	1	2	3	4
Spent time listening to him/her	1	2	3	4
Took his/her perspective and showed empathy	1	2	3	4
Expressed affection and care toward him/her	1	2	3	4
Invested attention and energy in his/her progress	1	2	3	4
Approached him/her in the home environment	1	2	3	4
Showed interest in day-to-day activities	1	2	3	4
Demonstrated clear organization for assisting in his/her behavior changes	1	2	3	4
Explained clear plans each week	1	2	3	4
Provided optimally challenging tasks for him/her	1	2	3	4
Provided helpful hints and reminders for him/her	1	2	3	4
Offered instructive and informative feedback to him/her	1	2	3	4

Appendix NN
Missing Data and Recording Errors

4.4.1 Intervention fidelity. Instructor self-report of need-supportive behaviours demonstrated during sessions was returned by all eligible instructors for each observation period, and no responses within the questionnaires were missing (see Table 12). Potential data entry errors were assessed by running descriptive statistics and frequencies for self-report and observed variables. No errors were identified in the data set.

Data was recorded as missing when a minimum of one rater was not able to complete a session observation. In total, two overall observations (e.g., autonomy support, structure, involvement, and goal setting environments) were recorded as missing and three observations specific to goal setting were recorded as missing. Missing data for overall observations occurred in session 15, wave 3, for the dieticians at both metropolitan locations as a result of recorded data lost by the project research officer upon return of the audio recorders. Given there were no formal instruction sessions remaining (e.g., only the cooking celebration remained), additional sessions could not be recorded. However, both instructors were involved with CAFAP from the outset and had acquired five previous session observations, which was greater than the number of observations recorded for the majority of additional instructors.

Wave 3, session 9 (south metropolitan) lead by the psychologist also failed to record due to battery power extinguishing after the previous recording, and the psychologist's difficulty in locating the spare batteries provided. Session 15 was subsequently recorded and used to replace the missing observation. Further, in session 4, of wave 2, the psychologist (wave 3, south metropolitan) wore the audio recorder but did not turn on the device. In this particular instance, a large portion of ratings were recorded by two observers

who attended the first half hour prior to departing to view the physiotherapist's session in the second half hour. Mean scores for behaviour observations were summed using the available rating scores.

Missing data specific only to goal setting was due to instructors choosing to turn the audio recorder off when administering goal setting content after previously having recorded all prior instruction content. This included the psychologist (south metropolitan) in session 9, wave 2, the exercise physiologist (south metropolitan) in session 15, wave 2, the dietician (south metropolitan) in session 15, wave 2, and the physiotherapist in session 9, wave 3 (regional).

At various stages throughout delivery of the instructor training and intensive program, a number of attempts were made to limit missing data due to perceived recording difficulties. Firstly, during the training sessions, instructors were advised of items that needed to be captured in the observations and the importance of recording session observations. In the week prior to each recording session, instructors were again reminded of the importance of obtaining complete recordings and the extent of items that were necessary to capture during the sessions. At this point instructors were provided instructions on methods for recording and asked to ensure the red light indicator was switched on and the timer running to indicate recording was taking place. In addition, the importance of recording the entire session was emphasised. Any instructors who returned incomplete recordings were asked to record an additional session, where possible, and reminded again of the items previously addressed. In all but one of the instances of missing goal setting data, additional recordings could not be conducted in future sessions due to the instructor not being included in future goal setting sessions within the program content due to the program concluding in the following session. In the additional instance, the instructor

was not able to record an alternative session due to being absent from the remaining goal setting session for personal reasons (e.g., physiotherapist in regional setting).

4.4.2 Adolescent anthropomorphic measures. No instances of missing data occurred for anthropomorphic measures. Recorded data was considered inaccurate when decreases in height were reflected across time points. Substantial inconsistencies were identified by individually plotting height scores across time for each participant and visually inspecting linearity. Instances when errors in recording occurred no attempts were made to follow-up with participants due to burden imposed on attending additional assessments. Measurements reported for the two most recent data collections were instead averaged and the mean reassigned to the incorrect data point. For example, if height at 3 months was less than height at post-program, then the mean of height at post-program and 6 months was computed. Alternatively, if data was not collected prior to inaccurate measurement, as was the case at entry assessment, the value recorded at pre-program was assigned to the entry score as variables were assumed to remain constant during the waitlist period.

Scores for height were adjusted for two participants at entry and four participants at pre-program. In each instance, BMI z-scores were adjusted based on the reassigned value.

4.4.3 Adolescent food diaries. Across all assessment periods, only two adolescents (one at entry and pre-program) returned a food diary with an insufficient level of data for the software program to calculate the average number of food serves. Both adolescents also failed to return a food diary for the remaining follow-up periods and as a result were excluded from analyses. The additional instances of missing data from the remaining participants occurred due to refusal to complete the food diary. Reasons for refusal included perceptions of being judged and/or discomfort in reporting limited changes, while others chose not to disclose their reasons for refusal to complete the food diary. Attempts were

made to reduce missing data by asking adolescents to clarify instances of limited reporting or to complete new diaries if the assessment period was still current. Further attempts were also made to mitigate perceptions of feeling judged. All food diaries were reviewed by the project dietician and details clarified with adolescents as required. Descriptive statistics and frequencies were analysed and hard copies referenced when inconsistencies were identified.

4.4.4 Physical activity. Of the adolescents enrolled for the duration of the program, only 16 wore the accelerometer for a minimum of one 6-hour day of wear time across all data collection periods. Given the low response rates at 12-month follow-up, the sample of 21 adolescents with complete accelerometer data across all time points up to 6 months was considered in analyses related to accelerometer wear. With the exception of one participant included in the 6 month analyses (e.g., with minimum of 3-day wear time across all assessment periods), all participants were enrolled for the duration of the 12-month follow-up. From the adolescents enrolled for the duration of the program with data at 6 months, none wore the accelerometer for a total of 7 days (with a minimum of 6-hour days) across all data collection points. The maximum amount of wear time across all data collection points with a minimum of a 6-hour day included 5 days and was completed by two adolescents, followed by 4 days completed by two adolescents, 3 days completed by 12 adolescents, 2 days completed by one adolescent, and a single day completed by three adolescents. Fifteen adolescents chose not to wear an accelerometer for a minimum of one data collection period.

Although reliability coefficients of accelerometer wear time have not been examined in adolescents, findings from a population-based sample of children (aged 7 years) suggest one 6-hour day of wear time has moderate to strong reliability (interclass correlation

coefficient = .69) (Rich et al., 2013). One 6-hour day of wear time was therefore chosen in the current study to maximize the sample of participants available for analyses. This resulted in a sample with 5.4(1.8) mean days of wear with a mean wear time of 743.5(95.5).

Reasons cited for returning an accelerometer with partial or no recorded wear time included: forgetting to wear accelerometer; actively choosing to not wear accelerometer due to embarrassment at school; not fitting appropriately with school uniform; and not feeling comfortable with physical activity being monitored due to limited post-program changes. In the majority of instances however, adolescents chose not to provide a reason for opting out of wearing the accelerometer.

Instances of missing data from completed questionnaires, in relation to self-reported frequencies, were successfully followed up by the research team, resulting in no outstanding data for physical activity frequency. Descriptive statistics and frequencies for accelerometer and self-reported physical activity were also examined to identify data-entry errors. No inconsistencies were found in the data set.

4.4.5 Adolescent questionnaires. Questionnaire data was recorded as missing for an adolescent at 3 months and a second adolescent at 6 months due to non-response for the entire questionnaire. An additional participant also chose to complete initial sections of the adolescent questionnaire at entry (e.g., physical activity, health-related quality of life, and depressive symptoms), but did not complete the remaining sections of the questionnaire (e.g., autonomous motivation and perceived parent support). In all instances reasons were not provided by adolescents for choosing not to return questionnaires. Missing data also occurred in two additional instances due to adolescents returning questionnaires without a full set of responses and failing to then respond to follow-up contact within the data collection period to clarify incomplete responses. Mean scores were substituted in such

cases by averaging the remaining questions with responses that captured the item missing. In the first instance, an adolescent's score for perceived parent support for healthy eating was derived by averaging all remaining scores and replacing the single missing value with this mean score. In the second instance, the single item missing referred to intrinsic motivation, and the remaining three scores measuring intrinsic motivation were averaged and this score used to replace the item missing. Potential data entry errors were assessed in the complete data set by reviewing descriptive statistics and frequencies for each respective data collection period. Hard copies were checked when inconsistencies were present.

4.4.6 Parent questionnaires. Questionnaire data was recorded as missing for one parent at post-program, two parents at 3 months, one parent at 6 months, and one parent at 12 months due to questionnaires remaining outstanding after the collection period had lapsed. In all instances a reason was not provided for choosing not to return the questionnaire. In addition to non-responses, missing data occurred in three additional forms. The first occurred in relation to the instrument used to assess parent autonomous motivation to support adolescent physical activity at all entry and pre-program assessments for wave 1 and all entry assessments for wave 2 due to a single question (e.g., "I support my adolescent's physical activity because I get pleasure and satisfaction from supporting my adolescent to regularly do physical activity") measuring intrinsic motivation being neglected from the printed questionnaire version. In these instances, the mean score from the remaining three items measuring intrinsic motivation was substituted for the missing item.

Incomplete data was also received for two parents in wave 2 with regard to intrinsic and introjected pre-program autonomous motivation, respectively, to support adolescent's physical activity. In line with the previously described procedures, a mean score substitute

was calculated from the remaining questions measuring the motivation type captured in the missing value (e.g., intrinsic and introjected).

Finally, data was also missing from the only parent pair who jointly attended program sessions. Responses from the mother were only provided at entry and pre-program assessments. With the exception of the pre-program assessment, data was returned by the father at all remaining assessments. The father's pre-program data was substituted using adjusted scores derived from applying the difference at entry between the mother's and father's scores to the mother's pre-program scores.

Descriptive statistics and frequencies were analysed for the complete data set for each variable across data points to identify potential data entry errors. No data entry errors were present.

4.4.7 Goal attainment. Goal attainment data recorded during the intensive intervention and set goals to attain at 3 months were detailed in each instructor's protocol for return at the final CAFAP session. Differences in return of goal setting items for these periods were due to instructors deviating from the protocol and choosing not to collect goal setting documents as stipulated. Reasons for not adhering to the protocol were not provided by instructors. Based on the limited return of goal setting data for wave 1 participants, extra attempts were made in waves 2 and 3 to ensure instructors adhered to protocol guidelines for collecting goal setting items. These steps included emailing all instructors in the week prior, verbally reminding instructors during phone call booster sessions, and bolding text in protocol instructions regarding collection steps.

In instances when progress ratings for program goals and recordings of goals set for 3 months were not returned, attempts were made by research team members to collect missing items. Data was missing when participants did not respond to follow-up requests or

when they had lost their goal setting booklets used during the program. Additional instances of missing data occurred at post-program follow-up assessments due to adolescents choosing not to complete progress ratings or set new goals. Reasons listed for choosing not to participate included feeling judged and not feeling comfortable assessing progress because of the limited behaviour changes made during the post-program period. Instances when goals set for the following assessment period were not returned, goal attainment scores for this period could not be recorded at the respective follow-up data collection.

Data-entry errors were checked by analysing descriptive statistics and frequencies for goal attainment scores across data collection periods. No data entry errors were identified.

Appendix OO

Correlation Matrices

Correlations Between Study Variables at Entry

	1	2	3	4	5	6	7	8	9	10	11	12
1. Fruit and veg.	1	-.206	-.147	.184	-.059	-.109	.087	.074	-.268	-.081	-.149	-.076
2. Junk food		1	.411*	-.177	-.045	.086	.119	-.223	129	-.288	-.011	.028
3. PA			1	.076	.060	-.179	-.289	-.125	.364*	.019	.126	.011
4. A mot. HE				1	.555*	.270	.153	.139	-.041	.414*	.331	.084
5. A mot. PA					1	.337	.252	.230	-.261	.399	.400	.120
6. Supp. HE						1	.824*	.163	-.432*	.203	.298	.057
7. Supp. PA							1	-.046	-.464*	.060	.218	.169
8. HRQL								1	-.590*	.311	.275	.088
9. Dep. symptoms									1	-.132	-.200	.015
10. A mot. supp. HE										1	.498*	.295
11. A mot supp. PA											1	.189
12. Need-supp.												1

Note: Fruit and veg. = fruit and vegetable serves; junk food = junk food serves; PA = physical activity; A mot. HE = motivation for healthy eating; A mot. PA = motivation for physical activity; Supp. HE = perceived parent support for healthy eating; Supp. PA = perceived parent support for physical activity; HRQL = health related quality of life; Dep. symptoms = depressive symptoms; A mot. supp. HE = parent motivation to support adolescent healthy eating; A mot. supp. PA = parent motivation to support adolescent physical activity; Need-supp. = Parent self-report demonstration of need-supportive behaviours.

*p< .05 (two-tailed)

Correlations Between Study Variables at Pre-Program

	1	2	3	4	5	6	7	8	9	10	11	12
1. Fruit and veg.	1	.280	.353*	.241	.064	.043	.006	.130	.227	.097	.111*	.012
2. Junk food		1	-.070	-.041	-.019	-.032	-.034	-.019	-.031	-.108	.033	.093
3. PA			1	.200	-.037	.013	.003	-.208	.310	-.021	.020	.219
4. A mot. HE				1	.467*	.210	.287	.079	.258	.039	.025	.081
5. A mot. PA					1	.431*	.469*	.413*	-.110	.307	.414*	.114
6. Supp. HE						1	.914*	.230	-.174	.382*	.394*	.341*
7. Supp. PA							1	.291	-.249	.322	.332	.269
8. HRQL								1	-.603*	.330	.324	-.123
9. Dep. symptoms									1	-.031	-.170	.095
10. A mot. supp. HE										1	.093*	.308
11. A mot supp. PA											1	.136
12. Need-supp.												1

Note: Fruit and veg. = fruit and vegetable serves; junk food = junk food serves; PA = physical activity; A mot. HE = motivation for healthy eating; A mot. PA = motivation for physical activity; Supp. HE = perceived parent support for healthy eating; Supp. PA = perceived parent support for physical activity; HRQL = health related quality of life; Dep. symptoms = depressive symptoms; A mot. supp. HE = parent motivation to support adolescent healthy eating; A mot. supp. PA = parent motivation to support adolescent physical activity; Need-supp. = Parent self-report demonstration of need-supportive behaviours.
*p< .05 (two-tailed)

Correlations Between Study Variables at Post-Program

	1	2	3	4	5	6	7	8	9	10	11	12
1. Fruit and veg.	1	-.021	-.205	.196	.122	.144	.079	-.041	-.220	.133	-.104	-.049
2. Junk food		1	.068	-.315	-.155	.024	.120	.117	-.087	.027	.028	.133
3. PA			1	.009	.244	.145	.129	.141	-.068	.143	.191	.327
4. A mot. HE				1	.585*	.514*	.365*	.134	-.189	.366*	.260	.176
5. A mot. PA					1	.471*	.399*	.352*	-.482	.295	.450*	.348*
6. Supp. HE						1	.872*	.110	.117	.185	.340	.228
7. Supp. PA							1	.162	-.104	.275	.001*	.050*
8. HRQL								1	-.787*	.249	.532*	-.001
9. Dep. symptoms									1	.366*	-.542*	.054
10. A mot. supp. HE										1	.501*	.133
11. A mot supp. PA											1	.162
12. Need-supp.												1

Note: Fruit and veg. = fruit and vegetable serves; junk food = junk food serves; PA = physical activity; A mot. HE = motivation for healthy eating; A mot. PA = motivation for physical activity; Supp. HE = perceived parent support for healthy eating; Supp. PA = perceived parent support for physical activity; HRQL = health related quality of life; Dep. symptoms = depressive symptoms; A mot. supp. HE = parent motivation to support adolescent healthy eating; A mot. supp. PA = parent motivation to support adolescent physical activity; Need-supp. = Parent self-report demonstration of need-supportive behaviours.
*p< .05 (two-tailed)

Correlations Between Study Variables at 3-Month Follow-Up

	1	2	3	4	5	6	7	8	9	10	11	12
1. Fruit and veg.	1	-.344	-.125	-.207	.145	.226	.329	.093	-.236	.050	.100	.373
2. Junk food		1	.059	.177	.101	.135*	.309	.118	.141	.352	.032	.101
3. PA			1	.312	.275	.030	.011	.277	-.191	.272	.219	.107
4. A mot. HE				1	.805*	.398*	.436*	.580*	-.308	.258	.548*	.223
5. A mot. PA					1	.322	.010*	.023*	-.418*	.335	.569*	.317
6. Supp. HE						1	.905*	.163	-.101	.095	.406*	.525*
7. Supp. PA							1	.339	-.279	.131	.480*	.509*
8. HRQL								1	-.784*	.412*	.476*	.121
9. Dep. symptoms									1	-.021	-.066*	-.001
10. A mot. supp. HE										1	.591*	.423*
11. A mot supp. PA											1	.588
12. Need-supp.												1

Note: Fruit and veg. = fruit and vegetable serves; junk food = junk food serves; PA = physical activity; A mot. HE = motivation for healthy eating; A mot. PA = motivation for physical activity; Supp. HE = perceived parent support for healthy eating; Supp. PA = perceived parent support for physical activity; HRQL = health related quality of life; Dep. symptoms = depressive symptoms; A mot. supp. HE = parent motivation to support adolescent healthy eating; A mot. supp. PA = parent motivation to support adolescent physical activity; Need-supp. = Parent self-report demonstration of need-supportive behaviours.
*p< .05 (two-tailed)

Correlations Between Study Variables at 6-Month Follow-Up

	1	2	3	4	5	6	7	8	9	10	11	12
1. Fruit and veg.	1	-.254	.000	.005	.205	.126	.247	.160	-.125	.204	.454*	.375*
2. Junk food		1	.035	-.193	-.100	.174	.070	-.270	.259	-.090	-.057	.107
3. PA			1	.250	.379*	.115	.133	.155	-.075	.045	.311	.119
4. Mot. HE				1	.645	.210	.272	.374	-.299	.482	.666	.273
5. Mot. PA					1	.311	.488*	.462*	-.346*	.487*	.555*	.357*
6. Supp. HE						1	.874*	.259	.163*	.539*	.469*	.586*
7. Supp. PA							1	.091	-.293	.518*	.456*	.627*
8. HRQL								1	-.786	.504	.399	.120
9. Dep. symptoms									1	-.385*	-.368*	-.244
10. A mot. supp. HE										1	.697*	.543*
11. A mot. supp. PA											1	.595*
12. Need-supp.												1

Note: Fruit and veg. = fruit and vegetable serves; junk food = junk food serves; PA = physical activity; A mot. HE = motivation for healthy eating; A mot. PA = motivation for physical activity; Supp. HE = perceived parent support for healthy eating; Supp. PA = perceived parent support for physical activity; HRQL = health related quality of life; Dep. symptoms. = depressive symptoms; A mot. supp. HE = parent motivation to support adolescent healthy eating; A mot. supp. PA = parent motivation to support adolescent physical activity; Need-supp. = Parent self-report demonstration of need-supportive behaviours.
*p< .05 (two-tailed)

Correlations Between Study Variables at 12-Month Follow-Up

	1	2	3	4	5	6	7	8	9	10	11	12
1. Fruit and veg.	1	-.108	.124	.088	.109	.108	.224	.401	-.369	-.012	-.030	-.154
2. Junk food		1	.198	.150	.075	.056	-.070	.075	-.267	-.199	-.048	.329
3. PA			1	.300	.321	.241	.208	.048	.034	.179	.114	.012
4. Mot. HE				1	.787*	.331	.327	.241	-.109	.289	.267	.169
5. Mot. PA					1	.218	.251	.417*	-.254	.373*	.418*	.023
6. Supp. HE						1	.935*	.102	-.197	.119	.097	.177
7. Supp. PA							1	.296	-.174	.185	.218	.064
8. HRQL								1	.787*	.179	.283	.169
9. Dep. symptoms									1	-.091	-.197	.133
10. A mot. supp. HE										1	.742*	.247
11. A mot supp. PA											1	.222
12. Need-supp.												1

Note: Fruit and veg. = fruit and vegetable serves; junk food = junk food serves; PA = physical activity; A mot. HE = motivation for healthy eating; A mot. PA = motivation for physical activity; Supp. HE = perceived parent support for healthy eating; Supp. PA = perceived parent support for physical activity; HRQL = health related quality of life; Dep. symptoms = depressive symptoms; A mot. supp. HE = parent motivation to support adolescent healthy eating; A mot. supp. PA = parent motivation to support adolescent physical activity; Need-supp. = Parent self-report demonstration of need-supportive behaviours.
*p< .05 (two-tailed)

Appendix PP

Objectives Excluded From Analyses

Objectives not included in analyses:

- adolescent motivation was hypothesised to explain the relationship between adolescent goal attainment and changes in the following adolescent outcomes:
    - physical activity behaviours (objective 3.8)
    - healthy eating behaviours (objective 3.9)
- changes in parent motivation to support adolescent behaviour change was hypothesised to explain the relationship between parent goal attainment and changes in the following adolescent outcomes:
    - physical activity behaviours (objective 3.10)
    - healthy eating behaviours (objective 3.11)

Appendix QQ

Description of Non-Significant Pathways (Objective 3.1 – Self-Report Physical Activity)

Changes following intervention in adolescent perceived parent support for physical activity was not a significant direct predictor of adolescent autonomous motivation for physical activity (Figure 5) at post-program, (β = .029, p > .05, R^2 = .001), 3 months, (β = .086, p > .05, R^2 = .007), 6 months, (β = .142, p > .05, R^2 = .020), and at 12 months, (β = .172, p > .05, R^2 = .030). Changes in adolescent autonomous motivation for physical activity were also found not to be a significant direct predictor of changes in adolescent self-reported physical activity at post-program, (β = -.059, p > .05, R^2 = .004), 3 months, (β = .126, p > .05, R^2 = .016), 6 months, (β = .123, p > .05, R^2 = .015), and at 12 months, (β = .095, p > .05, R^2 = .009). The direct pathway from changes in adolescent perceived parent support for physical activity to adolescent self-reported physical activity was shown not to be significant at post-program, (β = -.163, p > .05, R^2 = .027), 3 months, (β = -.114, p > .05, R^2 = .013), 6 months, (β = -.244, p > .05, R^2 = .060), and at 12 months (β = -.057, p > .05, R^2 = .003). The variance in self-reported physical activity accounted for by perceived parent support for physical activity (e.g., indirect effect) and autonomous motivation for physical activity was non-significant at post-program, (β = -.161, p > .05, R^2 = .030), 3 months, (β = -.126, p > .05, R^2 = .032), 6 months, (β = -.267, p > .05, R^2 = .085), and at 12 months, (β = -.076, p > .05, R^2 = .015).

Appendix RR

Description of Non-Significant Pathways (Objective 3.1 – Accelerometer-Based Physical Activity)

A non-significant direct relationship was demonstrated between changes in adolescent perceived parent support for physical activity and adolescent autonomous motivation for physical activity (Figure 5) at post-program, (β = .077, p > .05, R^2 = .006), 3 months, (β = .102, p > .05, R^2 = .010), 6 months, (β = .136, p > .05, R^2 = .019). Changes in adolescent autonomous motivation for physical activity were also shown not to be a significant direct predictor of changes in adolescent light intensity (e.g., at post-program (β = .291, p > .05, R^2 = .085), 3 months, (β = -.133, p > .05, R^2 = .018, and 6 months (β = -.236, p < .05, R^2 = .056), moderate-to-vigorous intensity (e.g., at post-program, (β = -.104, p > .05, R^2 = .011), 3 months, (β = -.105, p > .05, R^2 = .011), 6 months, (β = .046, p > .05, R^2 = .002)), and total (e.g., at post-program, (β = .209, p > .05, R^2 = .044), 3 months, (β = -.139, p > .05, R^2 = .019), 6 months, (β = -.204, p > .05, R^2 = .042)) physical activity. Although changes in adolescent perceived parent support for physical activity directly predicted changes in adolescent light (β = .398, p < .01, R^2 = .158) and total (β = .403, p < .01, R^2 = .162) physical activity at 6 months, no direct relationship was shown at post-program (β = -.020, p > .05, R^2 = .000; β = -.183, p > .05, R^2 = .034) and 3 months (β = .135, p > .05, R^2 = .018; β = -.001, p > .05, R^2 = .000) for light and total physical activity, respectively. Further, no relationship was shown between changes in adolescent perceived parent support and adolescent moderate-to-vigorous physical activity at post-program (β = -.374, p > .05, R^2 = .140), 3 months (β = -.300, p > .05, R^2 = .090), and 6 months (β = .161, p > .05, R^2 = .026). With the exception of light (β = .438, p < .05, R^2 = .231) and total (β = .439, p > .05, R^2 = .231) physical activity at 6 months, the variance in physical activity accounted for by perceived parent support (e.g.,

indirect effect) for physical activity and autonomous motivation for physical activity was non-significant when considering each measure of physical activity intensity: light (e.g., post-program, (β = -.043, p > .05, R^2 = 087) and 3 months, (β = .150, p > .05, R^2 = .040)), moderate-to-vigorous (e.g., post-program, (β = -.368, p > .05, R^2 = -.146), 3 months, (β = -.293, p > .05, R^2 = .096), 6 months, (β = .158, p > .05, R^2 = .027)), and total (e.g., post-program, (β = -.201, p > .05, R^2 = .084) and 3 months, (β = .014, p > .05, R^2 = .019)).

Appendix SS

Description of Non-Significant Pathways (Objective 3.2 – Junk Food Intake)

Mediation analyses with regard to junk food serves (Figure 6) showed changes in adolescent autonomous motivation for healthy eating did not have significant direct effects on changes in adolescent junk food serves at post-program (β = -.039, p > .05, R^2 = .002), 3 months, (β = -.131, p > .05, R^2 = .017), 6 months, (β = -.078, p > .05, R^2 = .006), and 12 months, (β = .219, p > .05, R^2 = .048). The predicted path between changes in adolescent perceived parent support for healthy eating and autonomous motivation for healthy eating was shown to be non-significant at post-program, (β = .399, p > .05, R^2 = .159), 3 months, (β = .014, p > .05, R^2 = .000), 6 months, (β = .158, p > .05, R^2 = .025), and 12 months (β = -.184, p > .05, R^2 = .034). Changes following intervention in adolescent perceived parent support for healthy eating was not a significant direct predictor of changes in adolescent junk food intake at post-program (β = .023, p > .05, R^2 = .001), 3 months, (β = .146, p > .05, R^2 = .021), 6 months, (β = -.256, p > .05, R^2 = .066), and 12 months, (β = -.072, p > .05, R^2 = .005), or a significant indirect predictor at post-program (β = .046, p > .05, R^2 = .003), 3 months, (β = .147, p > .05, R^2 = .039), 6 months, (β = -.250, p > .05, R^2 = .067), and 12 months, (β = -.033, p > .05, R^2 = .049).

Appendix TT

Description of Non-Significant Pathways (Objective 3.2 – Fruit and Vegetable Intake)

Analyses of the proposed model including fruit and vegetable serves as the endogenous variable (Figure 7), showed changes following intervention in adolescent autonomous motivation for healthy eating had no direct effects on changes in adolescent fruit and vegetable serves at post-program (β = .124, p > .05, R^2 = .015), 6 months, (β = .173, p > .05, R^2 = .030), and 12 months, (β = -.309, p > .05, R^2 = .096). The direct effect of changes in adolescent perceived parent support for healthy eating on adolescent fruit and vegetable serves was not significant at post-program (β = .378, p > .05, R^2 = .143), 3 months, (β = .144, p > .05, R^2 = .021), 6 months, (β = .330, p > .05, R^2 = .109), and 12 months, (β = .047, p > .05, R^2 = .002). Indirect effects in changes following intervention for adolescent perceived parent support for healthy eating through changes in adolescent autonomous motivation for healthy eating was shown not to be significant at post-program, (β = .391, p > .05, R^2 = .144), 3 months, (β = .148, p > .05, R^2 = .096), 6 months, (β = .310, p > .05, R^2 = .124), and 12 months, (β = -.011, p > .05, R^2 = .096).

Appendix UU

Description of Non-Significant Pathways (Objective 3.3 – Physical Activity)

With regard to health-related quality of life outcomes associated with physical activity variables (Figure 8), the direct pathway from changes in adolescent perceived parent support for physical activity to changes in adolescent health-related quality of life was no longer negative or significant at 3 months, (β = .220, p > .05, R^2 = .048), 6 months, (β = .047, p > .05, R^2 = .002), and 12 months, (β = .045, p > .05, R^2 = .002). The indirect effect of changes in adolescent perceived support for physical activity on changes in adolescent health-related quality of life was not-significant at 3 months, (β = .184, p > .05, R^2 = .224), 6 months, (β = -.017, p > .05, R^2 = .199), and 12 months, (β = -.025, p > .05, R^2 = .162).

Appendix VV

Description of Non-Significant Pathways (Objective 3.3 – Healthy Eating)

Results of analysis exploring the predicted paths in relation to health-related quality of life and outcomes associated with healthy eating (Figure 9) showed changes following intervention in adolescent autonomous motivation for healthy eating did not directly predict changes in adolescent health-related quality of life at post-program (β = .183, p > .05, R^2 = .033), 6 months (β = .256, p > .05, R^2 = .066), and 12 months (β = .380, p > .05, R^2 = .144). The path from changes in adolescent perceived parent support and autonomous motivation for healthy eating was shown to be non-significant at post-program (β = .274, p > .05, R^2 = .075), 3 months, (β = .130, p > .05, R^2 = .017), 6 months, (β = .201, p > .05, R^2 = .017), and 12 months, (β = -.133, p > .05, R^2 = .018). The direct pathway from changes in adolescent perceived parent support for healthy eating was no longer a significant or negative predictor of changes in adolescent health-related quality of life during follow-up periods at 3 months (β = .096, p > .05, R^2 = .090), 6 months (β = .006, p > .05, R^2 = .000), and 12 months (β = .087, p > .05, R^2 = .008). Indirect effects through changes in adolescent autonomous motivation for healthy eating was not significant at 3 months, (β = .032, p > .05, R^2 = .248), 6 months, (β = -.047, p > .05, R^2 = .068), and 12 months, (β = .140, p > .05, R^2 = .163).

Appendix WW

Description of Non-Significant Pathways (Objective 3.4 – Physical Activity)

With regard to depressive symptoms associated with physical activity variables (Figure 8), the direct pathway from changes in adolescent perceived parent support for physical activity to changes in adolescent depressive symptoms was negative and not significant at post-program (β = -.217, p > .05, R^2 = .047) and 12 months, (β = -.198, p > .05, R^2 = .039). The indirect effect of changes in adolescent perceived support for physical activity on changes in adolescent depressive symptoms was negative and not significant at post-program (β = -.204, p > .05, R^2 = .236) and 12 months, (β = -.127, p > .05, R^2 = .128).

Appendix XX

Description of Non-Significant Pathways (Objective 3.4 – Healthy Eating)

Analyses exploring the relationship among changes in adolescent perceived parent support, autonomous motivation, and depressive symptoms in the context of healthy eating (Figure 10) showed the direct pathway from autonomous motivation to depressive symptoms was not significant at post-program (β = -.365, p > .05, R^2 = .127), 6 months, (β = -.239, p > .05, R^2 = .057), and 12 months, (β = .065, p > .05, R^2 = .004). The direct pathway in which changes in adolescent perceived parent support predicted depressive symptoms was shown to be non-significant at post-program (β = -.190, p > .05, R^2 = .036), 3 months (β = -.197, p > .05, R^2 = .039), and 12 months, (β = -.167, p > .05, R^2 = .028). The indirect effect of changes in adolescent perceived parent support for healthy eating on changes in adolescent depressive symptoms through changes in adolescent autonomous motivation for healthy eating (Figure 11) was shown to be negative and non-significant at post-program (β = -.100, p > .05, R^2 = .136), 3 months, (β = -.139, p > .05, R^2 = .238), and 12 months (β = -.161, p > .05, R^2 = .030).

Appendix YY

Description of Non-Significant Pathways (Objective 3.5 – Self-Report Physical Activity)

Changes following intervention in parent need-supportive behaviour demonstrations were shown not to be a significant direct predictor of changes in adolescent self-reported physical activity (Figure 14) at post-program, (β = .099, p > .05, R^2 = .040), 3 months, (β = .005, p > .05, R^2 = .000), 6 months, (β = .229, p > .05, R^2 = .053), and at 12 months (β = .030, p > .05, R^2 = .001). Changes in parent need-supportive behaviour demonstrations were also shown not to be a significant direct predictor of changes in adolescent perceived parent support for physical activity at post-program, (β = -.012, p > .05, R^2 = .001), 3 months, (β = .007, p > .05, R^2 = .000), 6 months, (β = -.090, p > .05, R^2 = .008), and at 12 months (β = .165, p > .05, R^2 = .014). The predicted direct relationship between changes in parent autonomous motivation to support adolescent physical activity and parent demonstration of need-supportive behaviours was shown to be no longer significant at 3 months, (β = .097, p > .05, R^2 = .009), 6 months (β = .217, p > .05, R^2 = .047), and at 12 months (β = .241, p > .05, R^2 = .058). Direct effects of changes in parent autonomous motivation to support adolescent physical activity on changes in adolescent self-reported physical activity was not significant at post-program (β = -.040, p > .05, R^2 = .002), 3 months, (β = -.040, p > .05, R^2 = .002), 6 months, (β = .278, p > .05, R^2 = .077), and at 12 months (β = .012, p > .05, R^2 = .000). The indirect path to changes in adolescent self-reported physical activity from changes in parent autonomous motivation to support adolescent physical activity was shown to be not significant at post-program (β = -.087, p > .05, R^2 = .016), 3 months, (β = -.041, p > .05, R^2 = .002), 6 months, (β = .240, p > .05, R^2 = .107), and at 12 months (β = .005, p > .05, R^2 = .001). The predicted direct effect of changes in parent autonomous motivation to support adolescent physical activity on adolescent perceived parent support for physical activity was

no longer significant at 3 months, (β = -.124, p > .05, R^2 = .015), 6 months, (β = .218, p > .05, R^2 = .048), and at 12 months (β = .096, p > .05, R^2 = .009). A non-significant indirect effect on changes in adolescent perceived parent support for physical activity from changes in parent autonomous motivation to support physical activity was shown at 3 months, (β = -.126, p > .05, R^2 = .016), 6 months, (β = .249, p > .05, R^2 = .067), and at 12 months (β = .029, p > .05, R^2 = .030).

Appendix ZZ

Description of Non-Significant Pathways (Objective 3.5 – Accelerometer-Based Physical Activity)

Following intervention, changes in parent need-supportive behaviour demonstration did not have a significant direct effect on changes in adolescent moderate-to-vigorous intensity physical activity across all periods following intervention (e.g., post-program, (β = .047, $p > .05$, R2 = .002), 3 months, (β = -.290, $p > .05$, R2 = .084), 6 months, ($\beta = .292$, $p > .05$, $R^2 = .085$)), and total at 6 months, ($\beta = -.370$, $p > .05$, $R^2 = .137$) (Figure 13). Changes in parent need-supportive behaviour demonstrations were also shown not to be a significant direct predictor of changes in adolescent perceived parent support for physical activity at post-program, ($\beta = -.277$, $p > .05$, $R^2 = .077$), 3 months, ($\beta = -.270$, $p > .05$, $R^2 = .073$), and 6 months, ($\beta = -.225$, $p > .05$, $R^2 = .051$). The predicted direct relationship between changes in parent autonomous motivation to support adolescent physical activity and parent demonstration of need-supportive behaviours was no longer significant at 3 months, ($\beta = -.061$, $p > .05$, $R^2 = .004$) and 6 months, ($\beta = .090$, $p > .05$, $R^2 = .008$). Direct effects of changes in parent autonomous motivation to support adolescent physical activity on changes in adolescent light intensity (e.g., at 3 months, ($\beta = -.103$, $p > .05$, $R^2 = .011$), 6 months, ($\beta = .169$, $p > .05$, $R^2 = .029$)), moderate-to-vigorous intensity (e.g., at post-program, ($\beta = .036$, $p > .05$, $R^2 = .001$), 3 months, ($\beta = -.019$, $p > .05$, $R^2 = .000$), 6 months, ($\beta = -.077$, $p > .05$, $R^2 = .006$)), and total (e.g., at post-program, ($\beta = -.340$, $p > .05$, $R^2 = .119$), 3 months, ($\beta = -.086$, $p > .05$, $R^2 = .007$), 6 months, ($\beta = .138$, $p > .05$, $R^2 = .019$)) physical activity. Changes in parent autonomous motivation to support adolescent physical activity were also shown not to be a significant direct predictor of changes in adolescent perceived parent support for physical activity at post-program, ($\beta = -.203$, $p > .05$, $R^2 = .041$), 3 months, ($\beta = -.179$, $p > .05$, $R^2 =$

.032), and 6 months, (β = .205, p > .05, R^2 = .042). The indirect path from changes in parent autonomous motivation to support adolescent physical activity to changes in adolescent physical activity was shown to be non-significant with regard to light intensity (e.g., at post-program, (β = -.195, p > .05, R^2 = .160), 3 months, (β = -.123, p > .05, R^2 = .116), and 6 months (β = .214, p > .05, R^2 = .273), moderate-to-vigorous intensity (e.g., at post-program, (β = .014, p > .05, R^2 = .002), 3 months, (β = -.037, p > .05, R^2 = .085), 6 months, (β = -.104, p > .05, R^2 = .096)), and total (e.g., at post-program, (β = -.229, p > .05, R^2 = .127), 3 months (β = -.107, p > .05, R^2 = .102), and 6 months, (β = .172, p > .05, R^2 = .166)) physical activity. A non-significant indirect effect on changes in adolescent perceived parent support for physical activity from changes in parent autonomous motivation to support adolescent physical activity was shown at post-program (β = -.069, p > .05, R^2 = .080), 3 months, (β = -.197, p > .05, R^2 = .112), and 6 months, (β = .227, p > .05, R^2 = .102)).

Appendix AAA

Description of Non-Significant Pathways (Objective 3.6 – Junk Food and Fruit and Vegetable Intake)

Changes following intervention in parent demonstration of need-supportive behaviours did not have a direct effect on changes in adolescent junk food serves at post-program, (β = -.052, p > .05, R^2 = .003), 3 months, (β = -.106, p > .05, R^2 = .011), 6 months, (β = -.114, p > .05, R^2 = .013), and 12 months (β = -.117, p > .05, R^2 = .014), or serves of fruits and vegetables at post-program (β = -.072, p > .05, R^2 = .005), 3 months, (β = .079, p > .05, R^2 = .006), 6 months, (β = .048, p > .05, R^2 = .002), and 12 months (β = .198, p > .05, R^2 = .039). Changes in parent demonstration of need-supportive behaviours was also not a direct predictor of changes in adolescent perceived parent support for healthy eating at post-program (β = -.139, p > .05, R^2 = .019), 3 months, (β = -.245, p > .05, R^2 = .060), 6 months, (β = -.273, p > .05, R^2 = .075), and 12 months (β = .208, p > .05, R^2 = .043). The predicted direct path to changes in adolescent perceived parent support for healthy eating from changes in parent demonstration of need-supportive behaviours was not significant at post-program, (β = .028, p > .05, R^2 = .001), 6 months, (β = -.088, p > .05, R^2 = .008), and 12 months, (β = -.159, p > .05, R^2 = .025). The direct path from parent autonomous motivation to support adolescent healthy eating to changes in parent demonstration of need-supportive behaviour was no longer negative or significant at 3 months, (β = .160, p > .05, R^2 = .026), 6 months, (β = .112, p > .05, R^2 = .013), and 12 months, (β = .198, p > .05, R^2 = .025).

The direct pathway to each type of healthy eating behaviour from changes in parent autonomous motivation to support adolescent healthy eating was shown not to be significant, with the exception of fruit and vegetable serves at 3 months (β = -.282, p < .05, R^2 = .079) and junk food serves at 6 months, (β = -.498, p < .01, R^2 = .248). This included junk

food serves at post-program, (β = -.073, p > .05, R^2 = .005), 3 months, (β = -.082, p > .05, R^2 = .007), and 12 months, (β = -.125, p > .05, R^2 = .016); serves of fruits and vegetables at post-program, (β = .210, p > .05, R^2 = .044), 6 months, (β = .060, p > .05, R^2 = .004), and 12 months (β = .153, p > .05, R^2 = .023). Indirect pathways to healthy eating behaviours through changes in parent demonstration of need-supportive behaviours was also not significant for junk food serves at post-program, (β = -.120, p > .05, R^2 = .014), 3 months, (β = -.067, p > .05, R^2 = .15), and 12 months, (β = -.109, p > .05, R^2 = .025); serves of fruits and vegetables at post-program, (β = .221, p > .05, R^2 = .044), 6 months, (β = .055, p > .05, R^2 = .005), and 12 months, (β = .124, p > .05, R^2 = .054). The indirect pathway to changes in adolescent perceived parent support for healthy eating from changes in parent demonstration of need-supportive behaviours was also not significant at post-program, (β = .026, p > .05, R^2 = .021), 6 months, (β = -.058, p > .05, R^2 = .078), and 12 months, (β = -.197, p > .05, R^2 = .081).